SOLUBILITIES

OF

INORGANIC AND ORGANIC SUBSTANCES

A COMPILATION OF QUANTITATIVE SOLUBILITY DATA FROM THE PERIODICAL LITERATURE

BY

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PREFACE

The principal object in preparing a compilation of solubility data, from the point of view of the advancement of chemistry, is to furnish material for the origination and verification of theories of solution. The majority of investigators who have been engaged on such problems, have been compelled to determine experimentally the values required for developing the generalizations they hoped to establish. In fact, a large part of the most accurate data which are here brought together, are the outgrowth of such studies. It is hoped, therefore, that the present effort to make these and all other quantitative results more accessible for theoretical studies of solubility, will lead to noteworthy advances in this field of chemistry.

Of the various properties which determine the uses of compounds in a chemical way, solubility is of first importance. Therefore, solubility data are perhaps of even greater interest from a practical than from a theoretical point of view. For this reason it has been necessary to consider the needs of those who require such information only incidentally and may, therefore, be less familiar with some of the forms used for its expression. With this in mind, and at the suggestion of users of the preceding edition, chapters have been prepared in which are described, among other things, the sources of solubility data, the methods of calculating them to desired terms, the interpretation of their tabular arrangement, as well as some of the methods used for the accurate determination of solubilities.

Soon after the previous edition was issued, the collection of the new data, to be used in keeping the subject matter up to date, was systematically begun. In doing this, the experiment was made of examining each journal page by page, instead of scanning the titles of original papers contained in it. This resulted in the discovery of many data that would otherwise have been overlooked, and it soon became apparent that a more careful search of the literature than that previously made was necessary. It was, therefore, decided not only to examine the current periodicals minutely, but to go through the back volumes in a manner equally as thorough. The data collected in this way soon amounted to more than could be advantageously added as a supplement to the tables in the first edition, and it was decided to wait until the whole book could be completely rearranged, before making any additions

to the subject matter. It also appeared advisable to extend the scope to include freezing-point and certain other data, which had been omitted entirely from the first edition. The undertaking, therefore, developed far beyond the original expectation of regularly adding, from year to year, the new data which would keep the compilation up to date. Since the amount of time at my disposal for this work was limited, progress necessarily has been slow. Finally, the advent of the war extended the period far beyond the limit caused by other conditions.

Although the compilation has now been completed, I realize that in a work of this kind, more satisfactory results would have been achieved if several individuals had coöperated in its preparation. The recent decision of the American Chemical Society to extend its activities to the publication of reference books, will, I hope, insure that hereafter, compilations of the present character will be made in the exceptionally thorough manner which only an organization with elaborate facilities can provide.

In this connection I wish to express the opinion that the new venture of publishing compendia of chemical literature, which the chemical societies of England and America are just now about to undertake, will prove of service to the progress of chemistry in English speaking countries, second only to that rendered by the journals of original and of abstract literature, which these societies have so successfully developed.

I realize, more than ever, that opportunities for the occurrence of errors are innumerable and although I have endeavored to maintain unremitting vigilance to avoid them, my efforts toward this end have not always been successful. I desire to express my appreciation to all who have called attention to errors in the former edition and I will be equally grateful to those who point out to me needed corrections in the present book. In this connection, I am greatly indebted to Professor B. N. Menschutkin of the Polytechnic Institute (Sosnovka), Petrograd, Russia, who, in calling my attention to an error in the tabulation of some of his work given in the first edition, sent me a complete set of reprints of his many papers on solubility and personally corrected the tables which I prepared from them, for use in the present volume.

In conclusion I wish gratefully to acknowledge the assistance rendered me by Dr. W. S. Putnam of the Cooper Union of New York during the compilation of the first 150 pages of the tables.

A. S.

WASHINGTON, D. C.,
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GENERAL INFORMATION

The following detailed account of the collection and arrangement of the solubility data contained in the present volume, has been prepared particularly for those who need quantitative solubilities rarely, and are more or less unfamiliar with the usual tabular methods of expressing such data. To those who are better acquainted with the subject, the descriptions in some cases at least, will probably be considered more elementary than necessary. It is hoped, however, that with the aid of the explanations here given, no one need remain uncertain as to the true meaning of any result or form of expression found in the book.

Sources of the Data. — In addition to those determinations made for the specific purpose of ascertaining particular solubilities, many results are reported in connection with the study of theories of solution and are, therefore, easily located. On the other hand, since solubilities often form only an incidental part of an investigation, many valuable data can be found only by a very careful search of the literature. Consequently, in collecting material for the present compilation, the procedure was adopted of perusing, page by page, every volume of a selected number of chemical journals, for the years 1900 to 1918. In doing this, attention was paid particularly, to collecting all tabulated data, but a vigilant watch for solubility statements in the text was also maintained. The twenty-three journals which were examined in this manner are designated with asterisks (*) in the volume-year table of journals given at the end of the book. There is also listed in this table a somewhat larger number of other journals, containing relatively few papers in which solubility data may be expected. In these cases, a page by page examination would have required more effort than the results to be gained appeared to justify. Consequently, only the tables of contents of these journals were searched for references to solubility data. The last volume number given for each journal in this table shows the final volume examined as above mentioned.

Of the abstract journals, only "Chemical Abstracts" was systematically searched for references to data published in other than the twenty-three journals which were minutely examined. The original of practically all references obtained in this way was consulted.

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The larger handbooks of inorganic and organic chemistry, such as those of Dammer, Moissan, Gmelin-Kraut, Abegg, Beilstein and others, were not examined, since it was believed that the major part of the data so obtained would undoubtedly have been already collected from the journals.

Of the available compendia of physical constants, only the fourth edition of Landolt and Bornstein's "Tabellen" and the three issues of the international "Tables annuelles de Constantes et Données Numérique" were systematically examined, and in these cases the volumes were used principally to check the completeness of the compilation made directly from the journals.

Of the various pharmacopœias and pharmaceutical reference books, only the eighth edition of the U. S Pharmacopœia (1905) was used to any extent as a source of solubility data. Most of the results contained in the subsequent ninth edition (1916), are taken from the previous edition and calculated to the basis of volume, instead of weight, of solvent required to dissolve unit weight of solid. It is believed that, for the present compilation, the weight basis for expressing the results is to be preferred, and moreover, by taking the data directly from the eighth edition, the errors incidental to the recalculation and rounding off to whole numbers, are eliminated.

In this connection, it should be mentioned that the results obtained from pharmaceutical reference books for the more complex compounds such as the alkaloids, are for the most part of only qualitative interest, and although probably of sufficient exactness for use in pharmaceutical compounding, do not come within the scope of quantitative accuracy adopted for the present volume.

Collection and Compilation of the Data. — In all cases where solubility results were found recorded in an original communication, the data and accompanying descriptions of the experiments were copied and the record thus made filed for future use. In preparing these abstracts the actual experimental results were always recorded when available, rather than the values as recalculated by the author to terms which best suited the solution of the problem in hand. In many cases the original analytical data were not given and uncertainties arose as to the factors used and as to just how the calculations had been made. This was particularly true in the many cases where the results were expressed in gram molecular quantities per given volume of solution or on the basis of molecular percentage.

The supplementary information sought in each paper included such points as the method which had been employed for securing

equilibrium, the care exercised in purifying the material, the exact composition of the solid phase, the procedure followed in separating the saturated solution and analyzing it, as well as any other details which might be of value in forming a correct estimate of the accuracy of the work. The time consumed in this part of the examination of the original papers was usually found to have been well spent when the compilation of the solubility tables from these data sheets was undertaken. This was especially the case when it became necessary to compare the results for the same compounds obtained by two or more investigators. When practically all abstracting of the solubility data in the journals already referred to had been completed, the data sheets, which were at first grouped according to the journals examined, were arranged alphabetically in accordance with the names of the compounds for which data had been determined. In this way all results for a particular compound were brought together and the actual preparation of the systematically arranged tables could be begun.

It will be noted that by this plan the original papers were practically all consulted before the actual compilation of any of the data was started. In only a small percentage of cases was the author's paper again consulted, at the time the manuscript of the compiled tables was prepared or later. Although this plan introduces numerous opportunities for errors resulting from the recopying of the original data, it appeared to be the only practical procedure. A more direct transference of the original results to the finished page would have required that the work be done in the library or that a much larger number of books be withdrawn than is ordinarily permitted.

Although it was originally intended to have the manuscript pages typewritten before transmitting them to the printer, this plan had to be abandoned on account of the difficulty in obtaining the services of a competent person and also on account of the considerable added expense. This necessity may possibly have resulted advantageously, since one of the several opportunities for the introduction of mistakes through copying the figures, was eliminated.

The copy as forwarded to the printer was, for the most part, clear and legible but it was far from the orderly character of typewritten pages, consequently, it would be surprising if none of the many errors made by the compositors as a result of imperfect copy, were overlooked during the proof-reading, which from beginning to end was done without assistance. In order to reduce

typographical and all other errors to the least possible number, it would be necessary to compare every original paper with the final printer's proof and to repeat every calculation of a result one or more times. That this was not possible in the present case will be easily realized when the very large amount of the data is considered.

These details are mentioned at this time because it is believed that the user of the book is entitled to exact information in regard to the conditions under which the compilation was made. It is only with a clear understanding of its limitations that the book can be used to greatest advantage.

In this connection it should be pointed out that although opportunities for errors in recording the purely numerical data here brought together are abundant, in the majority of cases the mistakes are not necessarily misleading if proper regard is paid to the general import of the results as a whole. Thus on the basis of the well-established principle that changes in solubility, such as are due to temperature or concentration of solvent, always proceed regularly, errors in the case of one or more figures in a table will become apparent on careful comparison with the remaining results, or by plotting them on cross section paper and drawing the curve. Consequently, the table as a whole provides a check on the individual results of which it is composed.

Scope. — In brief, it may be stated that it has been the intention to include in this compilation, the actual results, or a reference to all quantitative solubility data, recorded in the journals referred to in a preceding section and listed in the table at the end of the book.

Freezing- or melting-points of binary or more complex systems, as explained in the footnote on page 1, are considered to be quantitative solubility data. The experimental results are quoted for only those systems in which one component is water or alcohol, or which are mixtures of fairly well-known compounds, and references are given to all others for which data were found

Owing to the uncertainty of the boundary between solubility and other equilibria, it has been necessary arbitrarily to draw the line in regard to certain data which it has appeared wise to exclude. In accordance with this, no attempt has been made to gather either figures or references, for the following:

(*a*) Melting-point data for mixtures of metals (alloys).

(*b*) Melting-point data for mixtures of minerals, except a few of relatively simple composition.

(c) Freezing-points of very dilute solutions made for the determination of molecular weights or electrolytic dissociation.

(d) Data for the solubility of gases in molten metals.

(e) The so-called solubility of metals in various solvents, due to a chemical reaction which occurs.

(f) Data for solid solutions.

(g) Data for compounds of unknown or variable composition.

Order of Arrangement. — The alphabetical arrangement is believed to have the advantage that data for particular compounds can be more easily located than would be the case if various compounds or systems had been grouped according to selected relationships. There is one difficulty which applies equally to any arrangement designed to avoid duplications, and that is the placing of those systems for which solubility results are given for two or more of the constituents involved. This applies especially to freezing-point lowering data for binary mixtures. In these cases the results show in turn the solubility of each component in the other and it is necessary to choose one, or to record the results under the name of each member in two separate places. There are many similar cases, in aqueous systems of two or more salts and of mixtures of liquids, where results are given in succession for the solubility of each component in solutions of varying concentrations of the other. In order to prevent duplication in these cases it was necessary arbitrarily to select that component under which the results for the entire system are to be recorded. In harmony with the general alphabetical plan of the book, it appeared most logical to make the selection on the basis of the alphabetical order of the names of the compounds involved. In the majority of cases, therefore, every system in which solubility data for two or more compounds are given, is placed under the name of that component, the initial of which comes earliest in the alphabet.

The advantage of this plan is that every system is assigned to a single position by rule and opportunities for unknowingly recording independent investigations of the same system, under different headings at widely separated portions of the book, are avoided.

An exception to this rule, which it was considered wise to observe, is in connection with mixed systems containing a compound of one of the rarer elements. In these cases, on account of the greater interest in the rare earth compound, the data have been located under its name.

In the case of those mixtures of salts and liquids which yield

liquid layers over certain concentrations and, therefore, to all intents and purposes become reciprocally soluble liquid mixtures, they are placed under the name of the salt or of that component which exists as a solid under ordinary conditions. It has only rarely been possible to give cross references in the body of the book, but in all cases those components of the mixtures, other than the one under which the data are alphabetically recorded, are included in the subject index of the book and the reader, therefore, should not fail to consult the index when results or a cross reference to the desired compound are not found in the proper place in the body of the book.

Nomenclature. — In regard to questions of the proper naming of compounds for the purpose of their correct alphabetical arrangement, particularly in respect to organic compounds, the usage followed in the index of "Chemical Abstracts" has been adopted. Thus the name under which a given compound is indexed in "Chemical Abstracts" is, in practically all cases, the one used for deciding its position in the present compilation.

The most notable deviation from this rule is in the case of compounds of those metals to which specific names, differing from the name of the metal itself, have been given; thus, for example in the present compilation, iron salts are not classed under ferrous and ferric and tin salts under stannous and stannic but under iron and tin, respectively. Another exception is the grouping of di and tri substituted amines under the mono substituted compound, instead of placing them under the widely separated headings Di and Tri. Thus results for diethylamine and triethylamine are given in connection with ethyl amine instead of being grouped, on the one hand with dimethyl, dipropyl, diphenyl, etc., amines, and on the other with trimethyl, tripropyl, triphenyl, etc., amines.

In harmony with the adoption of "Chemical Abstracts" as authority for the correct naming of compounds, the rules adopted for that publication (see, in connection with index to Vol. 11, 1917) have been followed as closely as possible in all other matters connected with systematic nomenclature. The exceptions which may be found are either mistakes, or occur in those tables reused from the first edition, in which corrections of the original plates would have cost more than the advantage to be gained appeared to justify. (For example, see first table, page 144, and many others in which the old forms of spelling names such as aniline, sulfate, glycerol, etc., have not been corrected.)

Abbreviations. — Although, in practically every case the abbre-

viations which have been used are identical with those adopted for "Chemical Abstracts" and will, in general, be readily understood, for the sake of accuracy and as a matter of convenience a list of those made use of in the present volume is given at the close of this chapter. (Page xxi.)

Literature References. — In order to save space, when several references must be given in connection with one result or table, and to avoid the repetition of the complete journal reference when data for different compounds are given in the same paper, an abbreviated form of reference, consisting of the name of the author and year of the work, has been adopted. These are to be used in connection with the author's index, in which the complete references are arranged chronologically under each name.

Deviations from this system occur in connection with the tables reused from the first edition. In these cases it was decided not to incur the expense of altering the plates simply for the sake of uniformity. The complete references given with the old tables are sometimes, but not always, repeated in the author's index.

Forms of Stating and Methods of Calculating Solubilities to Desired Terms. — When a solid compound is brought in contact with a liquid, more or less of it dissolves with the production of a homogeneous liquid mixture. The disappearance of the solid in the liquid continues, however, only up to a certain point, beyond which at a given temperature, no more of the solid can be made to dissolve. This quantity is designated as the solubility of the compound in the particular liquid. Solubility, therefore, always refers to a saturated solution and is expressed numerically in terms of the composition of the homogeneous liquid in equilibrium with an excess of undissolved solid. It is obvious that the composition of a saturated solution may be expressed in a great variety of terms and it is, therefore, to be expected that investigators will choose those terms which best suit the elucidation of the particular problems in hand.

As might be expected, the terms in most general use and those which permit of the widest applicability of the results, are based on the weights of the ingredients of the saturated solution. These may be either the weight of the dissolved compound contained in a unit weight (usually 100 grams) of the homogeneous liquid mixture, which corresponds to percentage of the dissolved compound in the saturated solution, or else the weight of the dissolved substance in a unit weight of the solvent. In either case the one form may be easily calculated to the other. Thus, for instance,

if it is found that 100 grams of the saturated solution contain 20 grams of the dissolved compound, there can be present only $100 - 20 = 80$ grams of solvent, and since this 80 grams of solvent holds 20 grams of the dissolved compound, $20 \div 80 \times 100 = 25$ grams of it are present per 100 grams of solvent. The calculation in the opposite direction is, of course, just as simple. If 100 grams of solvent contain 25 grams of dissolved compound, then $100 + 25$ grams of solution must contain 25 grams or 100 grams of saturated solution contain $\frac{25}{125} \times 100 = 20$ grams of the dissolved compound.

In the case of most solubility statements contained in the pharmaceutical literature, the results are given in terms of weight or volume of solvent required to dissolve unit weight of solid. Since all such results are simply the reciprocal of the terms, grams solid contained in unit number of grams of solvent, the procedure for transforming them to the more usual form simply involves dividing 1 gram by the stated number of grams of solvent. In those cases, however, where the amount of solvent is expressed in volume instead of weight, it is first necessary to multiply by the specific gravity of the solvent in order to find the weight corresponding to the given volume.

A more serious complication is, however, introduced in those cases where the results have been reported only in terms of volume of the saturated solution (100 cc. or 1 liter). On account of the change in volume which always results when a solid dissolves in a liquid, a calculation of the weight of the solvent present, when only the weight of the dissolved compound and total volume of the solution is given, cannot be made. In these cases it is also necessary to know the weight of a unit volume of the saturated solution, that is, its specific gravity, in order to convert the results from the volume to the weight basis. Consequently, for solubility results to be most generally useful, the specific gravity of the saturated solution should always be determined.

The calculation of a given result from the volume to the weight basis or vice versa, with the aid of the specific gravity (density), is readily understood when it is remembered that this factor is simply the weight in grams of 1 cc. of the solution. If, for example, it is stated that 100 cc. of saturated solution contain 25 grams of salt and the specific gravity is 1.15, it is apparent that 115 grams of the solution contain 25 grams of the salt, or 100 grams contain $\frac{25}{1.15} = 21.7$ grams. Conversely, when the calculation of the amount of salt in 100 cc. from that in 100 grams of solution is to

be made, the weight of dissolved compound must be multiplied by the specific gravity.

One of the forms of presenting solubility data for which especial care is needed in converting the values to a different basis is in the case of results for salts with water of crystallization. In some instances these results are expressed in weight of the hydrated compound in a given volume or weight of the saturated solution. If it is desired to ascertain the weight of anhydrous salt present, it will be necessary first to calculate the grams of anhydrous salt equivalent to the stated number of grams of the hydrated compound and, if the results have been expressed in terms of volume of saturated solution, this will be all that is necessary, but if, for instance, the grams of hydrated salt per 100 grams of saturated solution or of water have been given, then it will be necessary to add the weight of water present as water of crystallization in the salt, to the weight of water present as solvent. The total weight of solvent is, therefore, made up of the weight of water used for preparing the solution and that carried by the salt as H_2O of crystallization.

In the case of solvents composed of mixtures of water and alcohol, or other liquids, authors sometimes fail to specify whether the figures for such mixtures refer to the weight or volume basis, consequently, without a specific gravity determination, the exact composition of the mixture is uncertain. The above remarks concerning the calculation of solubility results from one form to another apply equally to determinations made in mixed solvents, provided all supplementary data for accurately establishing the composition of the mixed solvent are given.

Although in most cases the actual experimental results of solubility determinations are obtained in terms of weight, many investigators find that certain advantages are to be gained, in particular problems, by converting their analytical results to the basis of normality or gram molecules, and in practically all such cases it is not thought necessary to present also the gram quantities from which the molecular values were calculated. Although this may be justified from the narrow point of view of the particular problem in hand, it is greatly to be deplored when the broader aspects of the value of solubility data as a whole are considered. As already mentioned, solubility results which have been determined for some one purpose may frequently be applied to the solution of other problems, or serve in the development or testing of generalizations or of laws of solution. It is, therefore, important that in the case of

all solubility data the results should either be expressed in the gravimetric terms derived most directly from the experimental determinations, together with the specific gravities of, and solid phases in contact with the solutions, or else, when presented in terms more or less remote from those of the directly determined values, the method of making the calculations should be plainly indicated and all factors or supplementary data which have been used, presented in detail.

In preparing the present compilation occasion was several times taken to write to authors for data supplementary to those published, which although not essential to the solution of the particular problem in hand, and therefore omitted from the paper, were, nevertheless, needed for calculating the results to a form which would permit comparison with similar data by others or their use in the solution of other problems.

The calculation of results from the molecular basis to the gram basis or vice versa, introduces, in addition to the errors incidental to the calculation itself, those resulting from the selection of the atomic or molecular weights which are used as the factors. It is indeed rare for an author to state the actual molecular weights used for a calculation, and although the revisions of atomic weights which are occasionally made are usually not of great magnitude, opportunities for slight differences in recalculating results to a desired basis, due to differences in molecular weights, are worthy of consideration. A source of greater inaccuracies, however, is that resulting from the failure of authors to differentiate clearly between the significance of normality (gram equivalents) and gram molecules (formula weights) in calculating or in expressing their results.

It also occasionally happens that the compounds involved are described only by names which are not specific and a doubt may arise as to the exact formula expressing the composition of the compound in question. This applies particularly to work described in languages other than English. In cases of complex mixtures of several salts the results are sometimes given in terms of the ions present and the calculation of such results to the gram basis calls for especial care.

The general procedure for calculating gram quantities to the molecular basis consists simply in dividing by the molecular weight, or molecular equivalent weight in the case of results to be expressed in normality, and pointing off according to the unit quantity of solution selected. The reverse calculation is, of course, made by multiplying the molecular or normality values as given, by the

molecular, or molecular equivalent weights. An example which will illustrate the principal points involved, is the case of the calculation of the grams of dissolved compound per 100 grams of solvent, from a result expressed in terms of molecular per cent, that is, in terms of molecules of dissolved compound present in a total of 100 molecules of dissolved compound plus solvent. Thus, in the case of the solubility of mercuric iodide in pyridine, it has been found that the saturated solution at 100° contains 25 mol. per cent HgI_2, which designates a mixture of 25 gram mols. of HgI_2 and 100 − 25 = 75 gram mols. of pyridine. To convert to gram quantities, each figure is multiplied by the respective molecular weight and the product for the HgI_2 divided by the product for the C_5H_5N. Thus, $(25 \times 454.45) \div (75 \times 79.08) = 1.915$, which, $\times$ 100, = 191.5 grams HgI_2 per 100 grams of C_5H_5N.

Although, in the present compilation an attempt has been made to calculate as many as possible of the data to terms of weight of the compounds involved, especially for the commoner substances, this has not appeared advisable in some cases, either on account of uncertainties as to the factors to be used, or on account of the relative unimportance of the data and the considerable labor which would have been involved in making the calculations.

The principal terms used in expressing the solubility of gases in liquids are defined in connection with the tables of data in the body of the book. See, for instance, p. 227.

Explanation of Tables. -- Although the tables of results contained in the present volume will, it is hoped, be easily understood by all who are familiar with the subject, for the benefit of those who need solubility data only rarely, it has appeared desirable to mention some of the principles followed in constructing the tables and explain in detail the exact meaning of the results contained in a number of typical tables.

The main consideration in connection with a compilation such as the present one, is to arrange the very large amount of material in the most concise manner compatible with perfect clearness. It has, therefore, been necessary to adopt forms and abbreviations which eliminate the repetition of readily understandable details.

In general, it may be stated that the record of a solubility determination consists of the analytical results showing the composition of a homogeneous liquid mixture in equilibrium at a given temperature, with one or more solid compounds or with another homogeneous liquid mixture. In the case of aqueous solutions of salts, for instance, the analysis will show the weight of salt and of

water contained in a given amount of the saturated solution. In recording this analysis, however, as solubility data, it is not customary to state the weight of water directly, since its quantity is derivable from the given weight of salt and of solution (salt plus water). Thus, in all cases the amount of the dissolved compound is numerically reported in terms of unit quantity (100 grams, one liter, etc.) of the saturated solution or of the solvent. The tables, therefore, all show in the heading above the columns of figures, the terms in which the results are expressed (grams, cubic centimeters, gram molecules, etc.) and the unit quantity of solution or solvent in which the numerically recorded amounts of dissolved compound are contained. When more than one column of figures are inclosed under a bracket below the heading, the arrangement is an abbreviation designed to eliminate the repetition of the heading over each column separately, and, therefore, indicates that the heading applies independently to each separate column of figures. Thus, in the case of the table showing the solubility of sodium nitrate in water (see p. 656) the heading which is as follows:

t°	Gms $NaNO_3$ per 100 Gms Solution	Gms $NaNO_3$ per 100 Gms Water	Mols per Liter
0	42 2	72 9–73*	6 71*
10	44 7	80 8 80 5	7 16

when translated into its detailed meaning shows, (1) that at 0°, 100 grams of the saturated solution of sodium nitrate in water contain 42.2 grams $NaNO_3$, (2) that at 0°, 100 grams of water dissolve from 72.9 to 73 grams $NaNO_3$ according to the authorities quoted (Mulder or Berkeley), and (3) that one liter of a saturated solution of sodium nitrate in water at 0° contains 6.71 gram molecules of $NaNO_3$.

This general form of heading is typical and will be found in practically all cases where results for the solubility of a single salt in a single solvent at various temperatures are given. As will be noted, tables of this form show the results for a single series of determinations at increasing temperatures expressed in more than one set of terms. As a general rule, and especially when determinations of the specific gravities of the solutions are also given, any one of the figures for a given temperature may be calculated, as described in the previous section, from either of the others at the same temperature. The advantages of tables giving the results in several sets of terms are that the reader is relieved of making the calculations individually.

In a number of cases where, either the importance of the compound does not warrant very detailed results, or where similar data for several near related compounds have been determined, composite tables showing the results for two or more compounds in one or more solvents have been constructed. Although by this procedure considerable space has been saved and frequent repetitions avoided, it is possible that clearness has sometimes been sacrificed.

An example of such a composite table is that for the three compounds, $CdI_2.KI.H_2O$, $CdI_2\,2KI.2H_2O$ and $CdI_2.2NaI.6H_2O$ given in the first table on p. 178. The three solvents in which the solubilities were separately determined are placed in the first column of the table. Next follow the results for $CdI_2.KI.H_2O$, given in terms both of grams of anhydrous salt, $CdI_2.KI$, per 100 grams of solution and per 100 grams of solvent. The next group of figures shows successively the solubility of $CdI_2.2KI.2H_2O$ in water, in absolute alcohol and in absolute ether, reported in each case, in terms of grams of anhydrous salt per 100 grams of saturated solution and also in grams per 100 grams of each solvent. The last group of figures, columns 6 and 7, gives similar results for $CdI_2.2NaI.6H_2O$.

Other examples of this type of table are given on p. 188. In these cases results for three compounds, each in the same solvent but at different temperatures, are given. The abbreviation here adopted consists in providing only one column of temperatures to serve for each of the three sets of results given in the succeeding columns. This general plan is followed in a very large number of cases throughout the book.

One other example is that of the results for platinic double chlorides, given in the first table on p. 498. In this case, although each column of results represents an independent series of solubilities in water, they have all been grouped under the same bracket, instead of each being given under a separate, complete heading. By this plan a very compact arrangement has been provided but the results are apt to be misunderstood unless the reader bears in mind that here as elsewhere it has been necessary to condense the data as much as possible.

Before leaving the general subject of composite tables, attention should be called to one point which will be found illustrated in a large number of them. This is in reference to results at other temperatures than those which apply to the table as a whole, as recorded in the first column under the designation t°. In these cases the figure for the temperature is given in a parenthesis immediately following the result for grams of compound dissolved and, of course,

means that the particular determination was made at the temperature stated in the parenthesis, instead of at the temperature shown in the column t°, which applies to all the results not so modified.

This principle of indicating in parentheses any variations from the general order of the table, and also in respect to the introduction of additional matter, such as results for densities, points on the character of the solutions, etc., is one which has been followed in many instances.

As already stated, a solubility is an expression of the concentration of a solution in equilibrium with a particular solid compound. Therefore, if a compound can exist in more than one form at a given temperature, such as in different states of hydration, its solubility will show variations in accordance with which one of its forms is in contact with the saturated solution at the particular temperature. Information in regard to the solid phase is, consequently, essential to the accurate expression of a solubility. Whenever such facts are available they are shown in the tables by means of formulas recorded under the heading "Solid Phase." These formulas are usually placed on a line with the numerical results for the solution in contact with the solid represented by the formula given.

A case which illustrates strikingly the multiplicity of variations in solubility with change in degree of hydration is that of the solubility of the hydrates of ferric chloride in water (see p. 337). In this case, to economize space, the formula for the hydrate has been placed immediately above that group of data to which each refers, instead of on the same line with the results for each solution in contact with that particular hydrate. An examination of this table will show the apparent anomaly that the same hydrate possesses two different solubilities at certain temperatures. Thus, in the section of the table giving results for solutions in contact with the solid phase $Fe_2Cl_6.12H_2O$, it will be noted that 100 grams of H_2O dissolve 106.8 grams $FeCl_3$ at 30° and two lines below, the same amount of water is stated to dissolve 201.7 grams $FeCl_3$ at 30°. This is due to the fact that each of the hydrates gives a more or less well developed reverse solubility curve. The character of these curves is plainly indicated by plotting them on cross-section paper from the results given in the table. If this is done it will be seen that in case of the results for $Fe_2Cl_6.12H_2O$, the grams of $FeCl_3$ contained in 100 grams of water increase regularly with rise of temperature up to 37°, which is the melting-point of this hydrate. If

more crystals are added and the temperature raised above 37°, they melt and form a homogeneous solution of increased concentration. If, however, this more concentrated solution is cooled again below 37°, and crystals then added, they remain as solid phase and, when equilibrium is established, the composition of the solution corresponds to a point on the upper, reverse arm, of the solubility curve. With this salt, therefore, it is seen that for certain ranges of temperature the concentration of the saturated solution depends upon the procedure by which the point of equilibrium has been approached.

In cases where results are given for the solubility of a particular compound in aqueous solutions of another, the heading above the columns of figures shows, as usual, the terms in which the results are expressed (gms., cc., mols., etc.) and the unit amount of solution or solvent in which the recorded amounts of each compound is contained; while below the bracket are given, at the heads of the columns, the formulas of the respective compounds simultaneously present in the solution. Thus, there will usually be found in one column, the increasing concentrations of the salt present in the aqueous solution constituting the solvent, and in the other the amounts of the other compound of which the solubility is being determined and which is present as solid phase in contact with the solution. Examples of this form of table are those for the solubility of calcium sulfate in aqueous salt solutions (pp. 215 to 219) and numerous others throughout the book. In all cases where the solid phase exists in more than one form, this information, when available, is recorded in the usual manner in the column under the heading "Solid Phase." (See pp. 174, 185, 203, 404, and many others.) The results for the specific gravities of the saturated solutions are also given, when available. It is needless to say that, according to the arrangement of these tables, the figures in the horizontal lines refer to the same solution and those in the vertical columns to different solutions of the series.

In the case of tables showing the distribution of a compound between two immiscible solvents (see for example, results for mercuric chloride, pp. 420 and 421), the amounts of the dissolved compound in the conjugate layers are given under the same bracket with column headings designating the respective layers. In the case of equilibria in ternary systems, which form two liquid layers (see for example, last table, p. 511), the compositions of the upper and lower layers are given under separate brackets, the results on each horizontal line being for layers in contact with each other.

Data of this character are described more fully in the chapter on Methods for the Determination of Solubility.

The types of cases which have just been described were pointed out by users of the first edition of the book who did not understand the arrangement in these cases and suggested that an explicit description of them would make the book more generally useful. It is realized that the explanations which have been given here apply only to a certain proportion of the tables in the book. There are, no doubt, many tables and forms of expression, especially for the more complex systems, which will not be understood by the casual reader. In some of these cases brief remarks in connection with the tables have been given, but to just what extent these explanatory remarks are warranted, it has been difficult to decide. In conclusion, it should be mentioned that the title of the table is intended to describe the nature of the results and should always be used as a guide in the interpretation of the tabular arrangement.

ABBREVIATIONS

Most of the following abbreviations will be found written both with capitals and without.

$[\alpha]_D$. — Specific Rotation.
abs. — Absolute.
abs. coef. — Absorption Coefficient.
alcohol. — Ethyl Alcohol.
amt(s). — Amount(s).
anhy. — Anhydrous.
aq. — Aqueous.
atm(s). — Atmosphere(s).
at. wt. — Atomic Weight.
b.-pt. — Boiling-point.
C. — Centigrade.
calc — Calculate(ed).
cc. — Cubic Centimeter(s).
cm. — Centimeter(s).
coef — Coefficient.
com. — Commercial.
compd. — Compound.
conc. — Concentration, Concentrated.
cond. — Conductivity.
const. — Constant.
cor. — Corrected.
crit. — Critical.
cryo. — Cryohydric.
cryst. — Crystalline.
d. — Dextro (in connection with the name of an optically active compound).
d. — Density (d_{18} — Specific Gravity at 18°, referred to water at 4°, $d_{\frac{18}{20}}$ at 20° referred to water at 20°).
decomp. — Decomposition.
dif. — Different.
dil. — Dilute.
dist. coef. — Distribution Coefficient.
ed. — Edition.
elec. — Electric(al).
equil. — Equilibrium.
equiv. — Equivalent(s).
eutec. — Eutectic.
F. — Fahrenheit.
f.-pt. — Freezing-point.
g., gm., gms. — Gram(s).
gm. mol. — Gram Molecule(s).
G. M. — Gram Molecule(s).
hr(s). — Hour(s).
i. — $(d + l)$ Inactive (in connection with the name of an optically active compound)
inorg. — Inorganic.
insol. — Insoluble.
l. — Lævo (in connection with the name of an optically active compound).
kg kgm. — Kilogram(s).
l. — Liter(s).
mm. — Millimeter(s)
m. — Meta.
max. — Maximum.
mg., mgm. — Milligram(s).
mol(s). — Molecule(s), Molecular.
mol. wt. — Molecular Weight.
millimol. — Milligram Molecule.
m.-pt. — Melting-point.
n. — Normal (gm equiv per l).
N. — Normal (used rarely).
o. — Ortho.
ord. — Ordinary.
org. — Organic.
p. — Page.
p. — Para.
pet. — Petroleum.
ppt — Precipitate.
pt. — Point.
quad. pt — Quadruple Point.
qual. — Qualitative.
sapon — Saponification.
sat. — Saturated.
sol(s). — Solution(s).
sp gr. — Specific Gravity (Density).
sq. cm — Square Centimeter.
s. — Symmetrical.
sym. — Symmetrical.

ABBREVIATIONS

t°. — Temperature, Centigrade Scale.
temp(s). — Temperature(s).
tr. pt. — Transition Point.
vol(s). — Volume(s).
undissoc. — Undissociated.
U. S. P. — U. S. Pharmacopœia.
wt. — Weight.
∞ — Infinity.
$.10^{-2}$, $.10^{-5}$, etc., following a result means that the decimal point is to be moved as many places to the left as indicated by the minus exponent.

ACENAPHTHENE $C_{12}H_{10}$.

SOLUBILITY IN SEVERAL ORGANIC SOLVENTS.

(Speyers - Am J Sci [4] 14, 294, 1902)

NOTE. — In the original paper the results are given in terms of gram molecules of acenaphthene, acetamide, acetanilide, etc., per 100 gram molecules of solvent, at temperatures which varied with each solvent and with each weighing of the solutions. The tabulated results here given were obtained by recalculating and reading the figures from curves plotted on cross-section paper.

t°	In Methyl Alcohol. (a)	(b)	(c)	In Ethyl Alcohol (a)	(b)	(c)	In Propyl Alcohol (a)	(b)	(c)
0	81.33	1.80	0.39	81.1	1.9	0.57	82.3	2.26	0.88
10	80.40	1.70	0.38	80.3	2.8	0.84	81.8	2.40	1.00
20	79.60	2.25	0.48	79.6	4.0	1.20	81.4	3.40	1.35
30	79.00	3.50	0.72	79.1	5.6	1.70	80.9	4.75	1.90
40	78.45	6.00	1.20	78.7	8.4	2.60	80.6	7.10	2.90
50	78.15	9.00	1.77	78.8	13.2	3.90	80.7	11.10	4.40
60	78.30	11.70	2.35	79.4	23.2	7.00	81.5	19.60	8.20
70	78.60	14.30	2.90	80.75	40.5	12.50	83.9	37.00	16.20

t°.	In Chloroform (a)	(b)	(c)	In Toluene. (a)	(b)	(c)
0	143.8	16.4	12.7	90.7	13.18	7.9
10	140.1	20.6	16.0	90.8	18.0	10.7
20	136.3	27.0	19.5	91.0	24.5	14.5
30	132.4	34.0	25.0	91.8	33.5	20.5
40	128.0	42.5	32.0	92.7	47.0	28.0
50	123.4	51.5	40.0	94.0	60.5	35.7
60	119.3	62.5	50.0	95.5	74.0	43.5
70	...	.	...	97.2	89.0	52.5

(a) Weight of 100 cc solution in grams. (b) Grams dissolved substance per 100 grams solvent. (c) Gram molecules of dissolved substance per 100 gram molecules of solvent.

1000 gms. Aq. 25% NH_3 dissolve 0.07 gm. acenaphthene at 25°. (Hilpert, 1916).

RECIPROCAL SOLUBILITIES DETERMINED BY THE METHOD OF LOWERING OF THE FREEZING-POINT * ARE GIVEN BY GIUA (1915), FOR THE FOLLOWING PAIRS OF COMPOUNDS:

Acenaphthene + *m* Dinitrobenzene.
" + 2.4 Dinitrotoluene.
" + α Trinitrotoluene.

* *Freezing or Melting-point Curves as Solubility Data* — When a mixture of two compounds, rendered liquid by elevation of temperature, is gradually cooled, a point will be reached at which one or the other of the constituents will separate as a solid. This point represents the solubility of the one compound in the other. The method involved, differs principally from that ordinarily employed for solubility determinations, in that the composition of the mixture remains constant while the saturation temperature is being approached, instead of the reverse procedure.

* A considerable amount of data of this character is available, but, after careful consideration, it has been decided that references only will be given to it in the present volume, except in cases of mixtures of well-known compounds or of those in which water is one of the constituents.

ACENAPHTHENE

RECIPROCAL SOLUBILITIES (Freezing-point Lowering Data, see footnote, page 1) ARE GIVEN FOR THE FOLLOWING PAIRS OF COMPOUNDS:

Acenaphthene + Chloroacenaphthene	(Crompton and Walker, 1912)
" + Bromoacenaphthene	" "
" + Iodoacenaphthene	" "
" + Benzil	(Pawlewski, 1893)
" + p Nitrobenzoic Aldehyde	(Fazi, 1916)
" + Piperonilic Aldehyde	"
" + Vanillic Aldehyde	"
Chloroacenaphthene + Bromoacenaphthene	(Crompton and Walker, 1912.)
" " + Iodoacenaphthene	" "
Bromoacenaphthene + " "	" "

ACETALDEHYDE CH_3COH.

SOLUBILITY IN ETHYL ALCOHOL DETERMINED BY THE METHOD OF LOWERING OF FREEZING-POINT (de Leeuw, 1911). Liquid air was used as the cooling medium and temperatures were measured with the aid of a specially constructed resistance thermometer.

t°.	Wt Per Cent CH_3COH in Mixture	Mol Per Cent CH_3COH in Mixture	Solid Phase	t°.	Wt Per Cent CH_3COH in Mixture	Mol Per Cent CH_3COH in Mixture	Solid Phase
−123.3	100	100	CH_3COH	−122 3	51 8	50 7	$CH_3COH.C_2H_5OH$
−125 4	90 7	90 3	"	−125 3	45 6	44 5	"
−127 6	84 5	83 9	"	−128	40 6	39 5	$CH_3COH.2C_2H_5OH$
−132	80 9	80 2	(Eutectic)	−123 2	35.3	34 3	"
−126	78 1	77 3	$CH_3COH.C_2H_5OH$	−126 8	30 2	29 3	"
−126	75 2	74 4	"	−130 6	17 9	17 3	C_2H_5OH
−124 3	67 0	66 0	"	−120 6	10 2	9 8	"
−123 5	60 8	59 7	"	−114 9	0 0	0.0	"

Freezing-point data for mixtures of acetaldehyde and paraldehyde as well as the complete $x - T$ diagrams are given by Holleman (1903). Results for mixtures of paraldehyde and p xylene are given by Paterno and Ampola (1897).

Results for mixtures of the α and β forms of Acetaldehyde phenyl hydrazone are given by Laws and Sidgwick (1911).

ACETAMIDE $CH_3CO\,NH_2$.

SOLUBILITY IN WATER AND IN ALCOHOL.

(Speyers)

t°.	In Water. (a)	(b)	(c)	In Ethyl Alcohol (a)	(b)	(c)
0	105 5	70 8	29.6	85 62	17 3	18 5
10	104 9	81 0	34 0	86 2	24 0	26 0
20	104 3	97 5	40 8	87 3	31 5	33 8
30	103 7	114 0	47.7	88 8	40 5	43 0
40	103 0	133 0	55 5	90 7	50 0	53 5
50	102 3	154 0	64 0	93 0	61 0	64 5
60	101 6	177 5	74 0	95 5	72 0	76.5

(a) Wt of 100 cc sat solution in gms (b) Gms Acetamide per 100 gms solvent. (c) Gm mols. Acetamide per 100 gm mols solvent

100 gms. pyridine dissolve 17 75 gms. acetamide at 20–25°; 100 gms. aq. 50 per cent pyridine dissolve 84.7 gms. acetamide at 20–25°. (Dehn, 1917.)

Freezing-point curves are given for Acetamide + Benzene (Moles and Jimeno, 1913); Acetamide + Phthalide (Lautz, 1913); Acetamide + Triphenyl guanidine (Lautz, 1913); Tribromoacetamide + Trichloroacetamide (Küster, 1891).

ACETANILIDE $C_6H_5NH.COCH_3$.

SOLUBILITY IN SEVERAL SOLVENTS.

Solvent.	t°.	Sp. Gr. of Sat. Solution.	Gms. $C_6H_5NH.COCH_3$ per 100 Gms. Sat. Solution.	Authority.
Water	16	...	0.47	(Greenish and Smith, 1903.)
"	25	0.997	0.54	(Holleman and Antusch, 1894.)
"	30	1.000	0.69	(Seidell, 1907.)
Ether	25	..	2.8	(Marden and Dover, 1916.)
Formic Acid (95%)	16.8	1.121	56.74	(Aschan, 1913.)
Acetic Acid (99.5%)	21.5	...	33.21	(Seidell, 1907.)
Acetone	30-31	0.902	31.15	"
Amyl Acetate	"	0.882	10.46	"
Amyl Alcohol	25	..	14.00	"
Aniline	30-31	1.034	19.38	"
Benzene	"	0.875	2.46	"
Benzaldehyde	"	1.068	18.83	"
Toluene	25	0.862	0.50	"
Xylene	32.5	0.847	1.65	"
Pyridine	20-25	...	32.7	(Dehn, 1917.)
50% Aq. Pyridine	"	..	35.7	"
Petroleum Ether	about 20	.	0.03	(Salkower, 1916.)

SOLUBILITY IN METHYL ALCOHOL, ETHYL ALCOHOL AND IN CHLOROFORM.

(Speyers, 1902.) See Note, page 1.

	In CH_3OH		In C_2H_5OH		In $CHCl_3$	
t°.	Sp. Gr. of Sat. Solution.	Gms. $C_6H_5NH.COCH_3$ per 100 Gms. Sat. Solution.	Sp. Gr. of Sat. Solution.	Gms. $C_6H_5NH.COCH_3$ per 100 Gms. Sat. Solution.	Sp. Gr. of Sat. Solution.	Gms. $C_6H_5NH.COCH_3$ per 100 Gms. Sat. Solution.
0	0.860	18.5	0.842	12.8	1.503	3.53
10	0.864	23.1	0.844	16.7	1.475	7.24
20	0.875	29.1	0.850	21.3	1.440	10.7
30	0.892	35.1	0.860	26.5	1.398	14.5
40	0.911	42.9	0.874	32.9	1.354	18.7
50	0.932	51.7	0.895	39.4	1.314	23.7
60	0.957	59.2	0.920	46.4	1.272	29.1

SOLUBILITY OF ACETANILIDE IN MIXTURES OF ETHYL ALCOHOL AND WATER.

Wt. Per Cent C_2H_5OH in Solvent.	Results at 25° (Holleman and Antusch, 1894.)		Results at 30° (Seidell, 1907.)	
	Sp. Gr. of Sat. Solution.	Gms. $C_6H_5NH.COCH_3$ per 100 Gms. Sat. Solution.	Sp. Gr. of Sat. Solution.	Gms. $C_6H_5NH.COCH_3$ per 100 Gms. Sat. Solution.
0	0.997	0.54	1.000	0.69
10	0.985	0.93	0.984	1.00
20	0.973	1.28	0.970	2.20
30	0.962	2.30	0.956	4.80
40	0.950	4.85	0.945	9.40
50	0.939	8.87	0.934	15.40
60	0.928	14.17	0.926	22.00
70	0.918	19.84	0.917	27.60
80	0.907	25.17	0.907	31.20
85	0.899	26.93	0.900	31.70
90	0.890	27.65	0.893	31.60
95	0.874	26.82	0.885	30.80
100	0.851	24.77	0.876	29.00

(See remarks under α Acetnaphthalide, page 13.)

ACETANILIDE

SOLUBILITY OF ACETANILIDE IN MIXTURES OF ETHER AND CHLOROFORM AND OF ACETONE AND BENZENE AT 25°. (Marden and Dover, 1916)

Results for Ether-Chloroform Mixtures		Results for Acetone-Benzene Mixture.	
Wt Per Cent $CHCl_3$ in Mixed Solvent.	Gms $C_6H_5NH\,COCH_3$ per 100 Gms Mixed Solvent	Wt Per Cent C_6H_6 in Mixed Solvent.	Gms $C_6H_5NH\,COCH_3$ per 100 Gms Mixed Solvent
100	17 7	100	1.36
90	11.7	90	6.78
80	8.2	80	13 0
70	6.2	70	20 0
60	4.95	60	29.2
50	4.25	50	30 0
40	3 8	40	30.5
30	3.5	30	33.0
20	3 25	20	36 0
10	3 05	10	45 7
0	2 9	0	39 4

DISTRIBUTION OF ACETANILIDE BETWEEN IMMISCIBLE SOLVENTS AT 25°.

Conc. $C_6H_5NH.COCH_3$ in Benzene layer ÷ Conc. in H_2O layer = 1.65. (Farmer and Warth, 1904)

" " " Chloroform " ÷ Conc. in H_2O layer = 7.75. (Marden, 1914)

" " " Ether " ÷ Conc. in H_2O layer = 2.98. (Marden, 1914)

SOLUBILITY OF HALOGEN SUBSTITUTED ACETANILIDES IN ETHYL ALCOHOL AT DIFFERENT TEMPERATURES. (Chattaway and Lambert, 1915)

Gms. of Each Anilide per 100 Gms. of Each Sat Solution.

t°	p Chloro-acetanilide	2 4 Dichloro-acetanilide	p Bromo-acetanilide.	2 4 Dibromo-acetanilide.	4 Chloro 2 Bromo-acetanilide.	2 Chloro-4 Bromo-acetanilide.
5	...	.....	4 244	2 480		...
10	3 278	3 008	4 847	2.876	4 334	2 575
15	3 777	3 564	5 561	3 382	5 088	2 961
20	4 366	4 192	6 390	4 002	5 986	3 466
25	5 040	4 962	7 300	4.714	7.043	4 095
30	5 828	5 864	8 440	5 615	8 328	4 891
35	6 700	6 937	9 715	6.686	9 844	5 820
40	7 728	8 276	11 156	7 914	11 586	6 887
45	8 918	9 750	12 767	9 357	13 718	8 186

(Results for unstable needle forms of *p* bromoacetanilide and 2 4 dibromoacetanilide are also given)

SOLUBILITY OF *p* NITROACETANILIDE AND OF 2.4 DICHLOROACETANILIDE IN ACETIC ACID AT 16°. (Orton and King, 1911)

Compound	Solvent	Gms Cmpd Dissolved per 100 cc Sat Sol.
p Nitroacetanilide	Glacial Acetic Acid	0 83
"	50% Aq. " "	0.38
2.4 Dichloroacetanilide	Glacial Acetic Acid	6 37
"	50% Aq. " "	0 83

Freezing-point curves (see footnote, page 1) are given for mixtures of:

Acetanilide and Antipyrine	(Comanducci, 1912)
" " *m* Nitraniline	(Crompton and Whiteley, 1895)
" " *m* Dinitrobenzene	" "
" " *α* Dinitrophenol	" "
" " *p* Nitroacetanilide	(Kuster, 1891)
p Nitroacetanilide and Dinitroacetanilide	(Holleman and Sluiter, 1906.)
p Bromoacetanilide and 2.4 Dibromoacetanilide	(Sidgwick, 1915)

ACETIC ACID CH_3COOH.

RECIPROCAL SOLUBILITY OF ACETIC ACID AND WATER DETERMINED BY THE METHOD OF LOWERING OF THE FREEZING-POINT.

t°.	Gms CH_3COOH per 100 Gms Sat. Solution	Solid Phase	t°.	Gms CH_3COOH per 100 Gms Sat. Solution	Solid Phase
0	0	Ice	−20	67.0	CH_3COOH
−5	15.2	"	−15	72.3	"
−10	28.5	"	−10	77.5	"
−15	40.0	"	−5	82.2	"
−20	49.2	"	0	87.0	"
−25	57.0	"	+5	91.8	"
−26.7	60.0	(Eutectic)	10	95.8	"
−25	62.5	CH_3COOH	16.6	100.0	"

The data in the above table were obtained by plotting the results of Pickering (1893), Roloff (1895), Dahms (1896) (1899), de Coppet (1899), Kremann (1907), Faucon (1910), Balló (1910), Groschuff (1911), Paterno and Salimei (1913), and Tsakalotos (1914), on cross-section paper and drawing a curve through the points in best agreement. In addition to making determinations of the freezing-points of the mixtures, Balló also analyzed the solid phases which separated, and showed that these contained, in all cases, increasing percentages of acid and, therefore, must have consisted of mixed crystals. This formation of mixed crystals is offered as an explanation of the abnormality of the freezing-point lowering of the system.

SOLUBILITY OF ACETIC ACID IN ETHYL ALCOHOL (98.9%) DETERMINED BY THE METHOD OF LOWERING OF FREEZING-POINT (Pickering, 1893.)

t°.	Gms CH_3COOH per 100 Gms Sat. Solution	Solid Phase	t°.	Gms CH_3COOH per 100 Gms Sat. Solution	Solid Phase
−75	26.0	CH_3COOH	−10	67.7	CH_3COOH
−70	27.7	"	−5	73.2	"
−60	33.0	"	0	79.1	"
−50	38.2	"	+5	85.2	"
−40	43.7	"	10	91.5	"
−30	50.2	"	15	98.0	"
−20	58.0	"	16.6	100.0	"

(The original results were plotted on cross-section paper and the above figures read from the curve.)

SOLUBILITY DATA DETERMINED BY THE METHOD OF LOWERING OF THE FREEZING-POINT (see footnote, page 1) ARE GIVEN FOR MIXTURES OF **Acetic Acid** AND EACH OF THE FOLLOWING COMPOUNDS

Chloroacetic Acid (Mameli and Mannessier, 1913; Kendall, 1914)
Dichloroacetic Acid (Kendall, 1914)
Trichloroacetic Acid (Kendall, 1914)
Acetic Anhydride (Pickering, 1893)
Benzene (Dahms 1895, 1896, Roloff 1895, Groschuff, 1911, Baud, 1912, 1913 (*a*), Kendall and Booge, 1916)
Benzene + Vaseline (Roloff, 1895)
Benzene + Naphthalene (Roloff, 1895)
Benzene + Water (Roloff, 1895)
Benzoic Acid (Kendall, 1914)
Chlorobenzene (Baud, 1913 (*c*))
Nitrobenzene (Dahms, 1895; Baud, 1913 (*c*))
Carbon Disulfide (Pickering, 1893)
Cyclohexane (Baud, 1913 (*a*) (*b*))
Dimethylpyrone (Kendall, 1914 (*a*))
Dimethyl Oxalate (Kendall and Booge, 1916)
Dimethyl Succinate (Kendall and Booge, 1916)
Ethyl Ether (Pickering, 1893)
Ethylene Bromide (Dahms, 1895, Baud, 1912 (*a*))
Ethylene Dibromide (Baud, 1912 (*b*))
Formamide (English and Turner, 1915)
Formic Acid (Baud, 1913 (*c*))
Methyl Alcohol (Pickering, 1893)
Picric Acid (Kendall, 1916)
Propyl Alcohol (Pickering, 1893)
Sulfuric Acid (Pickering, 1893)
Thymol (Paterno and Ampola, 1897)
p Xylene (Paterno and Ampola, 1897.)

DISTRIBUTION OF ACETIC ACID BETWEEN:

Water and Amyl Alcohol at 20°. (Herz and Fischer, 1904.)

Gms CH_3COOH per 100 cc H_2O Layer	Gms CH_3COOH per 100 cc Alcoholic Layer.	G. M. CH_3COOH per 100 cc H_2O Layer	G. M. CH_3COOH per 100 cc Alcoholic Layer.
1	0 923	0 01	0 0095
2	1 847	0 03	0 0280
3	2 741	0 05	0 0460
4	3 694	0 07	0 0645
5	4 587	0 09	0 0830
6	5 475	0 11	0 1010
7	6 434	0 13	0 1190
8	7 328	..	.

Water and Benzene at 25°. (Herz and Fischer, 1905.)

Gms. CH_3COOH per 100 cc H_2O Layer.	Gms. CH_3COOH per 100 cc C_6H_6 Layer.	G M CH_3COOH per 100 cc H_2O Layer	G M CH_3COOH per 100 cc C_6H_6 Layer
5	0 130	0.05	0 0014
10	0 417	0 10	0 0005
20	1.55	0.20	0 0030
30	3 03	0.30	0 0290
40	4 95	0 50	0 051
..	...	0.70	0.090

NOTE.—The distribution results of Herz and co-workers are reported in millimolecules per 10 cc. portions of each layer in the several cases. To obtain the figures given in the tables here shown, the original results, before and after calculating to gram quantities, were plotted on cross-section paper, and from the curves thus obtained, readings for regular intervals of concentration of acetic acid in the aqueous layer were selected

DISTRIBUTION OF ACETIC ACID BETWEEN WATER AND BENZENE.
(Waddell, 1898, see also Lincoln, 1904.)

The measurements were made by adding varying amounts of benzene or water to 5 cc. of acetic acid and then running in water or benzene till saturation was reached. The observed readings were calculated to grams per 100 grams of the liquid mixture.

t°.	Upper Layer CH_3COOH	Upper Layer C_6H_6.	Upper Layer H_2O.	Lower Layer CH_3COOH.	Lower Layer C_6H_6	Lower Layer H_2O.
25	0 46	99 52	0 02	9 4	0 18	90.42
25	3 10	96 75	0 15	28 2	0 53	71 27
25	5 20	94 55	0 25	37 7	0 84	61 46
25	8.7	90 88	0 42	48 3	1 82	49 88
25	16 3	82 91	0 79	61 4	6 1	32 5
25	30 5	67 37	2 13	66 0	13 8	20 2
25	52 5	39.60	7 60	52 8	39 6	7 6
35	1 2	98.68	0 08	16 4	0 62	82 98
35	5 7	93 97	0 33	36 8	1 42	62 78
35	9 0	90.42	0.58	49 0	2 10	48 90
35	45 0	49.00	6 0	61.3	25 5	13 2
35	52 2	39.4	8.4	52 2	39 4	8 4

Additional data in connection with the distribution of acetic acid between water and benzene are given by King and Narracutt (1909), Kuriloff (1898), Farmer (1903), Bubanovic (1913), and Lincoln (1904). This latter investigator points out that the same degree of clouding does not represent the end point in all cases as was assumed by Waddell (1900).

Data for the distribution of acetic acid between benzene and aqueous solutions of sodium acetate at 25° are given by Farmer (1903).

Distribution of Acetic Acid between Water and Chloroform:

At Room Temperature.

(Wright, Thomson and Leon – 'Proc. Roy. Soc. 49, 185, 1891.)

Results in parts per 100 parts of solution

Upper Layer			Lower Layer		
CH_3COOH.	$CHCl_3$	H_2O.	CH_3COOH.	$CHCl_3$	H_2O.
0	0.84	99.16	0	99.01	0.99
6.46	0.92	92.62	1.04	98.24	0.72
17.69	0.79	81.52	3.83	94.98	1.19
25.10	1.21	73.69	6.77	91.85	1.38
33.71	2.97	63.32	11.05	87.82	1.13
44.12	7.30	48.58	17.72	80.00	2.28
50.18	15.11	34.71	25.75	70.13	4.12

At 25°.

(Herz and Lewy; Rothmund and Wilsmore.)

Gms. CH_3COOH per 100 cc.		G. M. CH_3COOH per 100 cc.	
H_2O Layer	$CHCl_3$ Layer	H_2O Layer	$CHCl_3$ Layer
2	0.089	0.05	0.0032
4	0.313	0.075	0.0062
6	0.596	0.120	0.0100
8	0.974	0.150	0.0198
10	1.130	0.175	0.0260
12	1.982	0.200	0.0325
20	5.10	0.30	0.070
30	10.2	0.50	0.170
40	15.3	0.70	0.275
50	21.9	0.80	0.335
52.3	39.54	0.87	0.659

See Note, page 6.

In addition to the above results, data for somewhat lower concentrations of acetic acid determined at 20° are given by Dawson and Grant (1901).

Results showing the influence of electrolytes upon the distribution of acetic acid between water and chloroform are given by Rothmund and Wilsmore and by Dawson and Grant.

Distribution of Acetic Acid at 25° between:

Water and Carbon Disulphide.

(Herz and Lewy.)

Gms CH_3COOH per 100 cc.		G. M. CH_3COOH per 100 cc.	
H_2O Layer.	CS_2 Layer	H_2O Layer.	CS_2 Layer.
65	2.64	1.1	0.45
70	3.0	1.2	0.55
75	3.3	1.2	0.80
80	5.4	1.35	0.97
85	6.4	1.4	1.3

Water and Carbon Tetrachloride

(Herz and Lewy.)

Gms CH_3COOH per 100 cc.		G. M. CH_3COOH per 100 cc.	
H_2O Layer.	CCl_4 Layer	H_2O Layer.	CCl_4 Layer.
30	1.8	0.5	0.03
40	3.0	0.7	0.055
50	4.8	0.9	0.095
60	5.8	1.1	0.155
70	12.0	1.2	0.235
76.2	25.2	1.27	0.420

Results for the distribution of acetic acid between water and mixtures of equal volumes of carbon disulfide and carbon tetrachloride at 25° are given by Herz and Kurzer (1910).

Distribution of Acetic Acid at 25° between:

Water and Bromoform.

(H. and L. — Z. Electro. Ch. 11, 818, '05.)

Gms CH_3COOH per 100 cc.		G. M. CH_3COOH per 100 cc.	
H_2O Layer.	$CHBr_3$ Layer.	H_2O Layer.	$CHBr_3$ Layer.
20	1.5	0.4	0.035
30	3.0	0.6	0.070
40	4.8	0.8	0.120
50	7.8	1.0	0.20
60	12.0	1.1	0.28
65	15.6	1.15	0.395
70	27.0	...	...

Water and Toluene.

(H. and F. — Ber. 38, 1140, '05.)

Gms CH_3COOH per 100 cc.		G. M. CH_3COOH per 100 cc.	
H_2O Layer.	$C_6H_5CH_3$ Layer	H_2O Layer	$C_6H_5CH_3$ Layer
5	0.119	0.1	0.0025
10	0.328	0.2	0.0075
20	1.132	0.4	0.0260
30	2.265	0.6	0.0530
40	3.725	0.8	0.090
50	5.841	1.0	0.140
60	8.344	...	...

See Note, page 6.

ACETIC ACID

DISTRIBUTION OF ACETIC ACID BETWEEN WATER AND ETHYL ETHER.
(de Kolossovsky, 1911.)

Results at Several Temperatures.

t°.	Gms. CH_3COOH per 100 cc. of H₂O Layer (p).	Ether Layer (p').	$\frac{p}{p'}$.
13	0.365	0.207	1.76
18	0.367	0.201	1.82
27	0.379	0.195	1.94
7.5	0.799	0.551	1.45
12	0.803	0.529	1.52
18	0.802	0.501	1.60
25	0.789	0.474	1.66

Results at 18°.

Gms. CH_3COOH per 100 cc. of H_2O Layer (p).	Ether Layer (p').	$\frac{p}{p'}$.
1.0	0.5	2.0
2.0	1.0	2.0
4.0	2.1	1.9
6.0	3.5	1.7
8.0	4.9	1.6
10.0	6.6	1.5
15.0	11.4	1.3
20.0	17.0	1.2
25.0	23.3	1.07

According to results obtained at 25° by Morgan and Benson (1907), the rati of distribution for concentrations of acetic acid up to 12 grams per 100 cc. c the H_2O layer is more nearly constant (1.92) than shown above for 18°. A similar constancy of distribution (approx. 2.08 at 15°) was also found by Pinnov (1915).

Results showing the influence of varying concentrations of a large number o electrolytes upon the distribution of acetic acid between water and ether ar given by de Kolossovsky, Dubrisay (1912), and by Hantzsch and Vagt (1901).

Data for the distribution of acetic acid between ether and molten $CaCl_2.6H_2O$ and ether and molten $LiNO_3.3H_2O$ are given by Morgan and Benson (1907).

One determination of the distribution of acetic acid between sat. aq. $CaCl_2$ solution (20 gms. per l.) and kerosene gave 97.7 gms. acid per 100 gms. aq. layer and 27 gms. per 100 gms. kerosene layer at ordinary temperature. (Crowell, 1918.)

DISTRIBUTION OF ACETIC ACID AT 25° BETWEEN:

Water and *o* or *p* Xylene.
(Herz and Fischer.)

Gms. CH_3COOH per 100 cc. H_2O Layer.	*o* or *p* Xylene Layer.	G. M. CH_3COOH per 100 cc. H_2O Layer.	*o* or *p* Xylene Layer.
5	0.24	0.1	0.004
10	0.48	0.2	0.010
20	1.13	0.4	0.025
30	2.15	0.6	0.047
40	3.40	0.8	0.079
50	5.10	1.0	0.122
60	7.27	1.2	0.230
70	12.52	...	...

Water and *m* Xylene.
(Herz and Fischer.)

Gms. CH_3COOH per 100 cc. H_2O Layer.	*m* Xylene Layer.	G. M. CH_3COOH per 100 cc. H_2O Layer.	*m* Xylene Layer.
5	0.06	0.1	0.0015
10	0.30	0.2	0.007
20	0.95	0.4	0.022
30	1.91	0.6	0.042
40	3.04	0.8	0.072
50	4.65	1.0	0.111
60	6.65	1.2	...

See Note, page 6.

Data showing effect of camphor on the reciprocal solubility of acetic acid and olive oil are given by Wingard, 1917.

ChloroACETIC ACIDS $CH_2ClCOOH$, $CHCl_2COOH$, and CCl_3COOH.

SOLUBILITY OF THE α, β, AND γ MODIFICATION OF MONOCHLOROACETIC ACID IN WATER AT DIFFERENT TEMPERATURES.

(Miers and Isaac, 1908, Pickering, 1895.)

The determinations were made by the sealed tube method. The following figures were obtained by plotting the original results on cross-section paper.

t°.	Gms. per 100 Gms. of Each Sat. Solution: α Modification	β Modification.	γ Modification.	t°.	Gms. per 100 Gms. of Each Sat. Solution: α Modification	β Modification	γ Modification
20	...	...	88.0	50	95.0	97.0	99.6
25	...	85.8	90.0	51 (m. pt.)	...	...?	100.0
30	86.0	88.2	92.2	55	97.2	99.3	...
35	88.4	90.6	94.1	56.5 (m. pt.)	...	100.0	...
40	90.8	93.0	95.8	60	99.0	...	...
45	93.0	95.0	97.8	62.4 (m. pt.)	100.0	...	...

Reciprocal solubilities of mono-, di-, and trichloroacetic acids and water determined by the freezing-point method are given by Pickering (1895).

SOLUBILITY OF TRICHLOROACETIC ACID IN WATER AT 25°.

(Seidell, 1910.)

100 gms. saturated solution of d_{25} = 1.615 contain 92.32 gms. CCl_3COOH.

SOLUBILITY DATA DETERMINED BY THE METHOD OF LOWERING OF THE FREEZING-POINT (see footnote, page 1) ARE GIVEN FOR MIXTURES OF **Chloroacetic Acid** AND EACH OF THE FOLLOWING COMPOUNDS:

Dichloroacetic Acid (Kendall, 1914)	Dimethyl Oxalate (Kendall and Booge, 1916)
Trichloroacetic Acid (Kendall, 1914)	Dimethyl Succinate (Kendall and Booge, 1916)
Acetophenone (Kendall and Gibbons, 1915)	Dimethylpyrone (Kendall, 1914 (a))
Dibenzyl Acetone (Kendall and Gibbons, 1915)	Naphthalene (Miers & Isaac, 1908, M. & M., 1913)
Benzil (Kendall and Gibbons, 1915)	Phenol (Kendall, 1916)
Benzene (Kendall and Booge, 1916)	Piperonal (Kendall & Gibbons, 1915, M. & M., 1913)
Benzoic Acid (Kendall, 1914)	Salol (Mameli and Mannessier, 1913)
Camphor (Pawlewski, 1893)	Sulfuric Acid (Kendall and Carpenter, 1914)
Cinnamic Acid (Kendall, 1914)	*o* Toluic Acid (Kendall, 1914)
Crotonic Acid "	*m* " " "
Cetyl Alcohol (Mameli and Mannessier, 1913)	*p* " " "
o Cresol (Kendall, 1914)	α " " "
Methyl Cinnamate (Kendall and Booge, 1916)	Vanillin (Kendall and Gibbons, 1915)

SOLUBILITY DATA DETERMINED BY THE METHOD OF LOWERING OF THE FREEZING-POINT (see footnote, page 1) ARE GIVEN BY KENDALL (1914) FOR MIXTURES OF **Dichloroacetic Acid** AND EACH OF THE FOLLOWING COMPOUNDS:

Trichloroacetic Acid	*o* Toluic Acid
Benzoic Acid	*m* " "
Cinnamic Acid	*p* " "
Crotonic Acid	α " " (Phenylacetic Acid)
Dimethylpyrone	

SOLUBILITY DATA DETERMINED BY THE METHOD OF LOWERING OF THE FREEZING-POINT (see footnote, page 1) ARE GIVEN FOR MIXTURES OF **Trichloroacetic Acid** AND EACH OF THE FOLLOWING COMPOUNDS:

Acetophenone (Kendall and Gibbons, 1915)
Anisaldehyde " "
Benzene (Kendall and Booge, 1916)
Benzaldehyde (Kendall and Gibbons, 1915)
m Hydroxy Benzaldehyde
p " "
o Nitro Benzaldehyde
m " "
p " "
Benzophenone
Benzil
Benzoquinone (Kendall and Gibbons, 1915)
Benzoic Acid (Kendall, 1914)
Camphene (Timofeiew & Kravtzov, 1915, 1917.)
Cinnamic Acid (Kendall, 1914)
Crotonic Acid "
o Cresol (Kendall, 1914)
m " "
p " "
Diethyl Oxalate (Kendall and Booge, 1916)
Diethyl Succinate " "
Dimethyl Oxalate " "
Dimethyl Malonate " "
Dimethyl Succinate " "
Dimethyl Terephthalate (Kendall and Booge, 1916)
Dimethylpyrone (Plotnikov, 1911; Kendall, 1914 (*a*))
Ethyl Ether (Tsakalotos and Guye, 1910.)
Ethyl Acetate (Kendall and Booge, 1916.)
Ethyl Benzoate " "
Methyl Benzoate " "
" Anisate " "
" Cinnamate " "
" *p* Toluate " "
α Naphthol (Kendall, 1916)
β " "
α Naphthyl Acetate (Kendall and Booge, 1916.)
β " " " "
Phenol (Kendall, 1916)
o Nitro Phenol (Kendall, 1916)
m " " "
p " " "
Piperonal (Kendall and Gibbons, 1915)
Nitro Piperonal " "
Phenyl Anisylketone " "
" Benzoate (Kendall and Booge, 1916.)
" Salicylate " "
Salicylic Aldehyde (Kendall and Gibbons, 1915.)
Sulfuric Acid (Kendall and Carpenter, 1914.)
o Toluic Acid (Kendall, 1914)
m " " "
p " " "
α " " "
Thymol (Kendall, 1916)
Vanillin (Kendall and Gibbons, 1915.)

DISTRIBUTION OF CHLORACETIC ACID BETWEEN:

(Herz and Fischer)

Water and Benzene at 25°.				Water and Toluene at 25°.			
Gms $CH_2ClCOOH$ per 100 cc		G. M $CH_2ClCOOH$ per 100 cc		Gms $CH_2ClCOOH$ per 100 cc		G. M $CH_2ClCOOH$ per 100 cc	
H_2O Layer.	C_6H_6 Layer	H_2O Layer.	C_6H_6 Layer.	H_2O Layer.	$C_6H_5CH_3$ Layer.	H_2O Layer	$C_6H_5CH_3$ Layer.
0.25*	8.69	0 0025	0.090	0 1*	5.22	0.001	0.055
0.5	15.59	0.005	0.155	0 5	20.31	0.005	0 20
1.0	27.87	0.010	0 28	1 0	34 87	0.010	0.36
1 5	41.10	0.015	0 415	1 5	49.14	0.015	0.50
2 0	52.90	0.02	0 54	2 0	60.46	0 02	0.62
3.0	68.01	0.03	0 70	3.0	72.28	0 03	0 77
4 0	76.52	0.04	0.79	4 0	81 72	0 04	0 85
				5.0	86.94	0.05	0.90

* See Note, page 6.

Additional data for the distribution of monochloroacetic acid between water and benzene as well as similar results for dichloroacetic acid are given by Georgievics, 1915.

DISTRIBUTION OF CHLORACETIC ACID BETWEEN:

(Herz and Lewy.)

Water and Chloroform at 25°. Water and Bromoform at 25°.

Gms. $CH_2ClCOOH$ per 100 cc. H_2O Layer.	Gms. $CH_2ClCOOH$ per 100 cc. $CHCl_3$ Layer.	G. M. $CH_2ClCOOH$ per 100 cc. H_2O Layer.	G. M. $CH_2ClCOOH$ per 100 cc. $CHCl_3$ Layer.	Gms. $CH_2ClCOOH$ per 100 cc. H_2O Layer.	Gms. $CH_2ClCOOH$ per 100 cc. $CHBr_3$ Layer.	G. M. $CH_2ClCOOH$ per 100 cc. H_2O Layer.	G. M. $CH_2ClCOOH$ per 100 cc. $CHBr_3$ Layer.
5*	0.283	0.05	0.0025	40*	0.850	0 45	0 011
10	0.614	0 10	0.0060	50	1 889	0 50	0 0165
20	1 088	0 20	0 0135	60	2 994	0 60	0 028
40	2.948	0.40	0 029	70	4 241	0 70	0 040
50	3.684	0.60	0 045	80	5 620	0 80	0 053
60	4.440	0.70	0 061	90	7 560	0 90	0 067
70	7.086	0.75	0.077	91 6	11 340	0 97	0.120

DISTRIBUTION OF CHLORACETIC ACID BETWEEN:

(Herz and Lewy.)

Water and Carbon Disulphide at 25°. Water and Carbon Tetrachloride at 25°.

Gms. $CH_2ClCOOH$ per 100 cc. H_2O Layer.	Gms. $CH_2ClCOOH$ per 100 cc. CS_2 Layer.	G. M. $CH_2ClCOOH$ per 100 cc. H_2O Layer.	G. M. $CH_2ClCOOH$ per 100 cc. CS_2 Layer.	Gms. $CH_2ClCOOH$ per 100 cc. H_2O Layer.	Gms. $CH_2ClCOOH$ per 100 cc. CCl_4 Layer.	G. M. $CH_2ClCOOH$ per 100 cc. H_2O Layer.	G. M. $CH_2ClCOOH$ per 100 cc. CCl_4 Layer.
60*	0.426	0 6	0 0042	90*	1 417	0.95	0 015[illegible]
80	0 691	0 8	0 007	95	2.031	1 00	0 0195
90	0.803	1.0	0 009	100	2.645	1 05	0 0270
100	1.040	1 05	0 0105	105	4 26	1 10	0 0415
105	1 464	1 10	0 015	106 7	5.19	1.13	0.0550
106.7	1.890	1.13	0.020				

* See Note, page 6.

Results showing the influence of sulfuric acid upon the distribution of monochloroacetic acid between water and ethyl ether at 26° are given by Hantzsch and Vagt (1901).

CyanoACETIC ACID $CH_2(CN)COOH$.

DISTRIBUTION OF CYANOACETIC ACID BETWEEN:

(Hantzsch and Sebalt, 1899.)

Water and Ethyl Ether.

t°.	Gms $CH_2(CN)COOH$ per Liter. H_2O Layer.	Gms $CH_2(CN)COOH$ per Liter. $(C_2H_5)_2O$ Layer.
0	0.070	0 042
10	0.076	0.044
21	0.083	0.030
30	0.089	0.027

Water and Benzene.

t°.	Gms $CH_2(CN)COOH$ per Liter H_2O Layer.	Gms $CH_2(CN)COOH$ per Liter C_6H_6 Layer.
6	0 067	0.020
25	0.130	0.019

PhenylACETIC ACID (α Toluic Acid) $CH_2(C_6H_5)COOH$.

SOLUBILITY IN WATER AND IN ALCOHOLS. (Timofeiew, 1894.)

Solvent.	t°.	Gms $CH_2(C_6H_5)COOH$ per 100 Gms Sat. Sol.	Solvent.	t°.	Gms $CH_2(C_6H_5)COOH$ per 100 Gms. Sat. Sol.
Water	20	1.64	Ethyl Alcohol	0.0	50.7
Methyl Alcohol	−17	50.6	"	+19.4	64.4
"	−13	53.2	"	20.0	65.1
"	0	59.2	Propyl Alcohol	−17.0	29.4
"	+19.4	70.8	"	−13.0	32.3
"	20	71.8	"	0.0	40.9
Ethyl Alcohol	−17	39.7	"	+19.4	56.8
"	−13	41.5	"	20.0	57.2

SOLUBILITY OF PHENYLACETIC ACID IN SEVERAL SOLVENTS AT 25°.
(Herz and Rathmann, 1913.)

Solvent.	Gms $CH_2(C_6H_5)COOH$ per 100 cc. Sat. Sol.	Solvent.	Gms $CH_2(C_6H_5)COOH$ per 100 cc. Sat. Sol.
Chloroform	60.17	Tetrachlorethylene	21.19
Carbon Tetrachloride	25.07	Tetrachlorethane	61.45
Trichlorethylene	44.89	Pentachlorethane	44.26

The freezing-point curve (Solubility, see footnote, page 1) is given by Salkowski (1885) for mixtures of phenylacetic acid and hydrocinnamic acid.

ACETIC ACID ESTERS.

SOLUBILITIES OF SEVERAL ACETIC ACID ESTERS IN AQUEOUS ALCOHOL AT ROOM TEMPERATURE. (Pfeiffer, 1892.)

cc. Ethyl Alcohol in Mixtures.	cc. H_2O added to cause separation of a second phase in mixtures of the given amounts of Alcohol and 3 cc. of				
	CH_3COOCH_3.	$CH_3COOC_2H_5$.	$CH_3COOC_3H_7$	$CH_3COOC_4H_9$.	$CH_3COOC_5H_{11}$.
3	∞	6.0	4.50	2.08	1.76
6	...	∞	10.48	6.08	4.24
9	...	...	17.80	10.46	9.03
12	...	...	26.00	15.37	13.24
15	...	...	35.63	20.42	17.52
18	...	...	47.50	26.60	22.22
21	...	...	58.71	31.49	26.99
24	...	...	∞	37.48	32.14
27	...	...	...	43.75	37.23
30	...	...	...	50.74	42.06
33	...	...	...	59.99	48.41

ChloroACETIC ACID ESTERS.

SOLUBILITY OF MONOCHLOR, DICHLOR, AND OF TRICHLORACETIC ESTER IN AQUEOUS ALCOHOL AT ROOM TEMPERATURE.

(Bancroft — Phys. Rev. 3, 193, 1895–96, from results of Pfeiffer, Z. physik. chem. 9, 469, '92.)

cc. Ethyl Alcohol in Mixtures.	cc. H_2O added to cause separation of a second phase in mixtures of the given amts. of Alcohol and 3 cc. of:		
	$CH_2ClCOOC_2H_5$.	$CHCl_2COOC_2H_5$	$CCl_3COOC_2H_5$.
3	1.32	0.90	0.65
6	4.01	2.45	1.80
9	7.30	4.33	3.02
12	10.78	6.60	4.50
15	16.16	9.20	6.50
18	22.16	...	...
21	28.74	...	...

Mono-, Di-, and Tri **ACETIN** $C_3H_5(OH)_2(OC_2H_3O)$, $C_3H_5(OH)(OC_2H_3O)_2$, and $C_3H_5(OC_2H_3O)_3$.

The partition coefficients of these three compounds between olive oil and water are given by Baum (1899) and Meyer (1901, 1909), as 0.06, 0.23, and 0.3 respectively.

Meth**ACETIN** (*p* Acetanisidine, or *p* oxymethylacetanilide) $C_6H_4.OCH_3.NHCH_3CO$.

100 gms. H_2O dissolve 0.19 gms. of the compound at 15° and 8.3 gms at 100°.

(German Pharmacopoeia)

α **ACETNAPHTHALIDE** $C_2H_3ONH(C_{10}H_7)$.

SOLUBILITY IN MIXTURES OF ALCOHOL AND WATER AT 25°.

(Holleman and Antusch — Rec. trav. chim. 13, 289, 1894)

Vol % Alcohol.	Gms per 100 Gms Solvent.	Sp Gr of Solutions	Vol % Alcohol.	Gms per 100 Gms. Solvent	Sp Gr of Solutions.
100	4.02	0.7916	65	1.78	0.8977
95	4.31	0.8150	60	1.44	0.9091
90	4.11	0.8344	55	1.02	0.9201
85	3.69	0.8485	50	0.71	0.9290
80	3.18	0.8624	35	0.25	0.9537
75	2.73	0.8761	20	0.09	0.9717
70	2.31	0.8798	10	0.04	0.9841

Constant agitation was not employed. The mixtures were allowed to stand in bath and the solutions analyzed after different lengths of time. Formulas are not given. This applies to all determinations by Holleman and Antush

ACETONE $(CH_3)_2CO$

SOLUBILITY OF ACETONE AT 25° IN AQUEOUS SOLUTIONS OF:

Electrolytes. Non-Electrolytes.

(Bell — J Phys. Ch. 9, 544, 1905; Linebarger — Am Ch. J. 14, 380, 1892)

Gms Electrolyte per 100 Gms. Aq. Solution.	Gms $(CH_3)_2CO$ per 100 Gms Solvent in Solutions of				Gms. Non-Electrolyte per 100 Gms Aq Solution	Gms $(CH_3)_2CO$ per 100 Gms Solvent in Solutions of		
	K_2CO_3	Na_2CO_3	$(NH_4)_2CO_3$	$MgCO_3$		$C_{10}H_8$†	Anethol *	$(C_6H_5)_2CO$
1.25	...	...	...	83.5	5	92.5	103.0	90.0
2.50	...	51.0	110.0	65.0	10	117.0	123.0	108.5
5.00	65.0	38.0	73.5	47.0	20	137.0	144.5	126.0
7.5	46.5	27.5	57.0	38.0	30	148.5	155.0	133.0
10.0	34.5	19.5	44.5	29.0	40	155.5	162.0	136.0
12.5	25.5	14.0	35.0	...	50	159.5	166.0	135.5
15.0	18.0	9.0	28.0	...	60	160.2	165.0	131.5
20.0	8.0	2.7	...	...	70	155.0	158.0	123.0
25.0	3.7	...	...	...	80	...	...	108.5
30.0	1.6	...	...	...	90	...	...	82.0

* Anethol = *p* Propenylanisol, $CH_3CH\,CH\,C_6H_4OCH_3$ † Naphthalene results at 35°

NOTE.—In the case of the results for the aqueous solutions of electrolytes, the determinations were made by adding successive small quantities of acetone to the mixtures of given amounts of water and electrolyte, and noting the point at which a clouding, due to the separation of a second phase, occurred. In the case of the aqueous non-electrolyte solutions, successive small amounts of water were added to mixtures of known amounts of acetone and the non-electrolyte. In all cases the results, as given in the original papers, have been recalculated and plotted on cross-section paper. From the curves so obtained, the above table was constructed.

Additional data for systems containing acetone are given under the salt involved, as, for instance, Potassium Carbonate, p. 511, Potassium Fluoride, p. 534, etc.

MISCIBILITY OF ACETONE AT 0° WITH MIXTURES OF:

Chloroform and Water (Bonner, 1910)				Bromobenzene and Water (Bonner, 1910).			
Gms $CHCl_3$.	Gms. H_2O.	Gms $(CH_3)_2CO$	Sp Gr of Mixture.	Gms. C_6H_5Br.	Gms. H_2O.	Gms $(CH_3)_2CO$.	Sp. Gr of Mixture.
0.988	0.012	0.501	1.18	0.977	0.023	0.685	1.12
0.900	0.100	1.300	1.01	0.90	0.10	1.13	1.01
0.792	0.208	1.633	0.98	0.80	0.20	1.41	0.98
0.696	0 304	1.750	0.96	0.70	0.30	1.52	0.97
0.600	0.400	1.770	0.95	0.60	0.40	1.57	0.96
0 500	0.500	1.720	0.94	0.50	0.50	1.60	0.95
*0.420	0 580	1.650	...	*0.49	0.51	1.60	...
0 400	0.600	1 630	0.93	0 40	0 60	1 59	0 94
0.300	0.700	1 530	0 94	0.30	0.70	1.55	0 93
0 200	0.800	1.321	0.95	0.20	0.80	1 46	0 93
0.100	0.900	1.144	0.97	0 10	0.90	1 30	0.93
0 018	0.982	0 464	0.98	0.02	0.98	0 849	0.95

NOTE. — The determinations were made by gradually adding acetone to the mixtures of the given amounts of water and the other constituent until a homogeneous solution was obtained The results give the binodal curve for the system. The author also determined "tie lines" showing the compositions of the various pairs of liquids which may exist in equilibrium When the two layers are practically of the same composition the tie line is reduced to a point designated as the "plait point" of the binodal curve. This point is indicated by a * in the above tables.

SOLUBILITY OF ACETONE IN AQUEOUS SOLUTIONS OF CARBOHYDRATES.

(Krug and McElroy — J. Anal. Ch. 6, 184, '92; Bell — J. Phys. Ch. 9, 547, '05.)

In Aqueous Solutions of Cane Sugar.

Per cent Sugar.	Gms. $(CH_3)_2CO$ per 100 Gms. Sugar Solution at: 15°.	20°.	25°.	30°.	35°	40°.
10	597.2	...	581.8	...	574 8	...
20	272.5	...	250.0	...	251 8	...
30	172.4	...	150.0	...	150.6	...
35	...	...	..	...	...	110
40	...	96.4	92.8	89 8	...	85
45	...	71 9	68 8	65 7	...	62
50	...	50 8	48.1	45.9	...	42
55	...	35 8	33.8	32 5	...	29
60	...	25 2	24 2	23.4	...	...
65	...	18.3	17 7	17.0	...	...
70	...	13.2	12.8	12.5	...	...

In Aqueous Dextrose Solutions. In Aqueous Maltose Solutions.

Per cent Dextrose.	Gms. $(CH_3)_2CO$ per 100 Gms. Solvent at: 15°.	25°.	35°.	Per cent Maltose.	Gms. $(CH_3)_2CO$ per 100 Gms. Solvent at: 15°.	25°.	35°.
10	736.7	747 9	761.5	10	353.6	348.1	342.0
20	255 3	247 7	240.8	20	185.4	181.2	176.9
30	157.5	149.8	142 5	30	119.9	116.9	112.4
40	86 9	79.6	74.0	40	78.4	74.7	70.5
50	36 2	33 0	31.2	50	46.2	42 9	39.8

The determinations were made as in the case of the solubility of acetone in aqueous solutions of electrolytes. See preceding page.

DISTRIBUTION OF ACETONE BETWEEN:

Benzene and Water.

Results at 20°. (Philip and Bramby, 1915) Gm $(CH_3)_2CO$ per 1000 cc		Results at 25°. (Herz and Fischer, 1905) Gms $(CH_3)_2CO$ per 1000 cc	
H_2O Layer.	C_6H_6 Layer.	H_2O Layer	C_6H_6 Layer
0.10	0.08	10*	12.0
0.20	0.12	50	41.7
0.30	0.25	100	101.5
0.40	0.34	150	155 9
...	...	200	225 0

Toluene and Water. At Different Temps. (Hantzsch and Vagt, 1901) Gms $(CH_3)_2CO$ per 1000 cc

t°.	H_2O Layer.	$C_6H_5CH_3$ Layer
0	2.105	0 993
10	2.000	0 957
20	1 960	0 957
30	1 867	0 957
...	...	..

* See Note, page 6

Philip and Bramby also give data for the effect of NaCl, KCl and LiCl upon the distribution of acetone between benzene and water.

In the determinations by Hantzsch and Vagt the equilibrium was approached from above. The amount of acetone in the lower layer was determined by analysis, and that in the upper layer calculated by difference.

DISTRIBUTION OF ACETONE BETWEEN:
(Herz and Rathmann, 1913)

Water and Carbon Tetrachloride. Mols $(CH_3)_2CO$ per Liter.		Water and Chloroform. Mols $(CH_3)_2CO$ per Liter		Water and Pentachlorethane. Mols $(CH_3)_2CO$ per Liter	
H_2O Layer.	CCl_4 Layer	H_2O Layer	$CHCl_3$ Layer	H_2O Layer	C_2HCl_5 Layer
0.186	0 0833	0 032	0 168	0 144	0 251
0.322	0.146	0 0781	0 399	0 271	0 469
1.01	0 514	0 145	0 676	0.541	0 859
1.66	0 997	0 263	1 17	0.806	1 275
2.87	2.10	0 493	1 98	1.149	1 763
...	...	1 01	3 06	...	...

Water and Tetrachlorethane. Mols $(CH_3)_2CO$ per Liter		Water and Tetrachlorethylene. Mols $(CH_3)_2CO$ per Liter		Water and Trichlorethylene. Mols $(CH_3)_2CO$ per Liter	
H_2O Layer	$C_2H_2Cl_4$ Layer.	H_2O Layer	CCl_2CCl_2 Layer	H_2O Layer	$CHClCCl_2$ Layer
0.0812	0 341	0 274	0 081	0 160	0 193
0.249	0 994	0 562	0 174	0 350	0 359
0.317	1.210	1.020	0 343	0 654	0 719
0.363	1 323	1 545	0 629	0 946	1 029
0.569	1.936	2 007	0 891	1.389	1.562

The distribution coefficient of acetone between olive oil and water is given by Meyer (1901), as 0.146 at 3° and 0 235 at 30°.

SOLUBILITY DATA DETERMINED BY THE METHOD OF LOWERING OF THE FREEZING-POINT (see footnote, p. 1) ARE GIVEN FOR MIXTURES OF **Acetone** AND EACH OF THE FOLLOWING COMPOUNDS:

Bromine	(Maass and McIntosh, 1912)	Phenol	(Schmidlin and Lang, 1910)
Chlorine	" "	Resorcinol	" "
Hydrobromic Acid	" "	Pyrogallol	" "
Chloroform	(Tskalotos and Guye, 1910)	Pyrocatechol	" "
o Chlorophenol	(Bramby, 1916)		

Depression of the freezing-point of mixtures of acetone and water and each of the following compounds are given by Waddell (1899): Ether, hydroquinone, phenol, *p* nitrophenol, salicylic acid.

ACETOPHENONE $CH_3COC_6H_5$.

The freezing-point curve for mixtures of acetophenone and sulfuric acid is given by Kendall and Carpenter (1914).

Freezing-point curves (solubility, see footnote, page 1) for mixtures of Cinnamylidene **Acetophenone** and each of the following compounds are given by Giua (1916): Acenaphthene, azobenzene, ethyl ether and α trinitrotoluene.

ACETYLACETONE $CH_3COCH_2COCH_3$.

SOLUBILITY IN WATER.

(Rothmund — Z. phys. Ch. 26, 475, '98)

t°.	Gms $CH_3COCH_2COCH_3$ per 100 Gms. H_2O Layer.	Gms $CH_3COCH_2COCH_3$ per 100 Gms. Acetyl Acetone Layer
30	15 46	95 02
40	17 58	93 68
50	20 22	91 90
60	23 23	89 41
70	27.10	85 77
80	33 92	78 82
87.7 (crit. temp.)	56.8	

NOTE. — Weighed amounts of water and acetyl acetone were placed in small glass tubes, which were then sealed and slowly heated until the contained mixtures became homogeneous. The temperature was then allowed to fall very gradually and the point noted at which cloudiness appeared. This point was accurately established for each tube by repeated trials. The curve plotted from these determinations shows two percentage amounts of acetyl acetone which cause cloudiness at each temperature below the critical point. Of these two points, for each temperature, one represents the aqueous layer, *i.e.*, the solubility of acetyl acetone in water, and the other represents the acetyl acetone layer, *i.e.*, the solubility of water in acetyl acetone. This method is known as the "Synthetic Method," and yields results in harmony with those obtained by the analytical method, *i.e.*, by analyzing each layer after complete separation occurs. See also, chapter on Methods of Solubility Determinations.

ACETYLENE C_2H_2.

SOLUBILITY IN WATER.

(Winkler; see Landolt and Bornstein's Tabellen, 3d ed p 601, '05)

t°.	α.	q.
0	1 73	0.20
5	1 49	0.17
10	1.31	0.15
15	1.15	0.13
20	1.03	0 12
25	0.93	0.11
30	0.84	0.09

α, "Absorption Coefficient," = the volume of gas (reduced to 0° and 760 mm. pressure) taken up by one volume of the liquid at the given temperature when the partial pressure of the gas equals 760 mm. mercury.

q, "Solubility," = the amount of gas in grams which is taken up by 100 grams of the pure solvent at the given temperature if the total pressure, *i.e.*, the partial pressure of the gas plus the vapor pressure of the liquid at the absorption temperature, is 760 mm.

SOLUBILITY OF ACETYLENE IN WATER, AQUEOUS SOLUTIONS OF ALKALIES AND SULFURIC ACID AT 15°.

(Billitzer, 1902.)

Aq. Solution of	l_{15} of Acetylene in Aq. Solutions of Normality:									
	0.01	0.025	0.05	0.10	0.15	0.25	0.50	1.00	2.00	3.00
$Ba(OH)_2$	...	1.218	...	1.230	1.240	...	...	...	...	...
$Ca(OH)_2$	1.230	...	...	...	...	...	...	...	...	...
NH_4OH	1.216	...	...	1.218	...	1.220	1.225	1.230	1.235	1.240
NaOH	1.210	...	1.200	1.180	...	1.128	1.040	0.885	0.600	0.370
KOH	1.212	...	...	1.185	...	1.130	1.056	0.912	0.660	0.460
Na_2SO_4	...	...	...	1.170	...	1.068	0.940	0.720	0.340	
H_2SO_4	...	...	...	1.190	...	...	1.120	1.040	0.900	0.780

SOLUBILITY IN WATER, l_{15} = 1.251.

The above results were determined by the method of Ostwald (Handbuch physiko-chemischen Messungen 207 ff.). A thermostat was used and great care taken to reduce experimental errors and purify the acetylene. The results are in terms of the *Ostwald Solubility Expression*, for which see page 227, following.

SOLUBILITY OF ACETYLENE IN AQUEOUS ACETONE SOLUTIONS.

(Kremann and Honel, 1913.)

Vol. Per Cent H_2O in Solvent (H_2O + Acetone).	Gms. C_2H_2 dissolved per Liter Sat. Solution at		
	0°	18°	25°.
0	37	21	15.2
5	31	18.2	13.5
10	26	15.0	10.5
20	15	9.5	8.0
35	8.4	5.5	4.45
50	5.7	1.23	2.22
75	...	...	1.23
100	...	...	0.98

The freezing-point curve for mixtures of acetylene and methyl ether are given by Baume and German (1911, 1914).

ACETYLENE Biiodide, **cis** and **trans.**

Data for the lowering of the freezing-points of mixtures of these two isomers are given by Chavanne and Vos (1914).

ACONITIC ACID $C_3H_3(COOH)_3$

100 grams of formic acid (95% HCOOH) dissolve 2.01 grams $C_3H_3(COOH)_3$ at 20.6° C. (Aschan, 1913.)

ACONITINE (Amorphous) $C_{34}H_{47}NO_{11}$.

SOLUBILITY IN SEVERAL SOLVENTS.

(At 25° U.S.P., at 18°–22°, Muller — Apoth.-Ztg. 18, 2, '03.)

Solvent.	Gms. $C_{34}H_{47}NO_{11}$ per 100 Gms. Solvent at:		Solvent.	Gms. $C_{34}H_{47}NO_{11}$ per 100 Gms. Solvent at:	
	18°–22°.	25°.		18°–22°.	25°.
Water	0.054	0.031	Benzene	..	17.85
Alcohol	...	4.54	Carbon Tetrachloride	1.99	...
Ether	1.44	2.27	Petroleum Ether	0.023	0.028

100 gms. H_2O dissolve 0.0226 gm. aconitine at 22° (Dunstan and Umney, 1892.)
" " abs. alcohol " 2.7 " " " " (Jurgens, 1885.)
" " " ether " 1.56 " " " " "

TrichloroACRYLIC ACID CCl_2:CClCOOH.

SOLUBILITY OF TRICHLOROACRYLIC ACID IN WATER

(Boeseken and Carriere, 1915.)

t°.	Gms CCl_2:CClCOOH per 100 Gms. Sat Solution.	Solid Phase.
0.0 "	0 0	Ice
−0.36	2 0	"
− 0 6 Eutec.	4 5	Ice+CCl_2:CClCOOH $2\frac{1}{2}H_2O$
+13.7 "	64.1	CCl_2 CClCOOH.$2\frac{1}{2}H_2O$
15 0	68 5	"
17 0	74 5	"
19 2 m. pt.	80 0	"
17.0 Eutec.	81.1	CCl_2:CClCOOH+ CCl_2 CClCOOH $2\frac{1}{2}H_2O$
20.3 "	82 8	CCl_2.CClCOOH
25.0	84 5	"
30 0	86 0	"
40 0	89 5	"
50 0	92.5	"
60 0	94 5	"
70 0	98 5	"
72.9	100.0	"

Between the concentration 4.5 and 64 1 two liquid layers are formed. The percentage of CCl_2:CClCOOH in each is as follows:

t°.	Gms CCl_2 CClCOOH per 100 Gms Sat. Solution. Lower Layer.	Upper Layer.
10	5.0	...
20	5.2	64.1
30	6 0	63.8
40	7.5	62.2
50	13.0	59.5
55	18.0	56.0
60	27 0	49.0
62 crit. t.	38.0	

The original results were plotted on cross-section paper and the above figures read from the curves.

ACTINIUM EMANATIONS.

SOLUBILITY IN SEVERAL SOLVENTS.

(Hevesy, 1912.)

A method was elaborated for determining the partition coefficient between a gas and a liquid phase. The solubility of actinium emanations was then determined in KCl, H_2O, H_2SO_4, C_2H_5OH, $C_5H_{11}OH$, $(CH_3)_2CO$, C_6H_5CHO, C_6H_6, C_7H_8, petroleum ether and CS_2. The solubility increases in the order named. Close relations are indicated between actinium, thorium and radium.

ADIPIC ACID (Normal) $(CH_2)_4(COOH)_2$.

100 grams H_2O dissolve 1.44 grams adipic acid at 15°.

(Henry — Compt. rend., 99, 1157, '84; Lamouroux — *Ibid*, 128, 998, '99.)

ADIPINIC ACID $(CH_2)_4(COOH)_2$.

100 grams of formic acid (95% HCOOH) dissolve 4.04 grams of $(CH_2)_4(COOH)_2$ at 18.5°; 100 cc. of the saturated solution contain 4.684 grams of the acid. (Aschan, 1913.)

AGARIC ACID $C_{10}H_{30}O_5.H_2O$.

100 grams trichloroethylene dissolve 0.014 gram agaric acid at 15°.

(Wester and Bruins, 1914.)

SOLUBILITY IN WATER.

(Winkler — Ber. 34, 1409, '01, see also Peterson and Sondern — Ber 22, 1439, '89)

t°.	B.	B'.	cc* of atmospheric O and N per liter of. Dist H_2O (at 760 mm) Oxygen.	Dist H_2O Nitrogen	Sea Water (at 760 mm). Oxygen	Sea Water Nitrogen
0	0.02881	0 02864	10 19	18 45	7 77	14 85
5	.02543	.02521	8 91	16 30	6 93	13 32
10	02264	.02237	7 87	14 50	6 29	12 06
15	.02045	02011	7 04	13 07	5 70	11 05
20	01869	.01826	6 35	11 91	. .	10 25
25	01724	.01671	5 75	10 96	...	9 62
30	01606	.01539	5 24	10 15		
40	01418	01315	4 48	8 67		
50	01297	01140	3.85	7 55		
60	01216	.00978	3 28	6 50		
80	01126	.00600	1.97	4 03		
100	.01105	.00000	0 00	0 00		

B = "Coefficient of Absorption," *i.e.*, the amount of gas dissolved by the liquid when the pressure of the gas itself without the tension of the liquid amounts to 760 mm.

B' = "Solubility," *i e*, the amount of gas, reduced to 0° and 760 mm., which is absorbed by one volume of the liquid when the barometer indicates 760 mm. pressure.

* Reduced to 0° and 760 mm.

SOLUBILITY OF AIR IN AQUEOUS SULPHURIC ACID AT 18° AND 760 MM.

(Tower — Z anorg Ch 50, 382, '06)

Wt. % H_2SO_4	98	90	80	70	60	50
Solubility Coef.	0.0173	0.0069	0.0069	0.0055	0 0059	0 0076

SOLUBILITY OF AIR IN ALCOHOL, ETC.

(Robinet, 1864)

Solvent	Vols Air per 100 Vols Solvent	Solvent	Vols Air per 100 Vols Solvent.
Alcohol (95 1%)	14 1	Oil of Lavender	6 9
Petroleum	6 8	Oil of Turpentine	24 2
Benzene	14 0		

ALANINE (α Aminopropionic Acid) $CH_3CH(NH_2)COOH$.

SOLUBILITY IN MIXTURES OF ALCOHOL AND WATER AT 25°.

(Holleman and Antusch, 1894.)

Vol % Alcohol.	Gms per 100 Gms Solvent	Sp Gr of Solutions	Vol % Alcohol.	Gms per 100 Gms. Solvent.	Sp Gr of Solutions.
0	16 47	1 0421	35	4 91	0 9670
5	14 37	1 0311	40	3 89	0 9577
10	12 43	1 0280	50	2 38	0 9355
15	10 49	1 0101	60	1 57	0 9102
20	8 48	0 9984	70	0 85	0 8836
25	7.11	0 9886	80	0 37	0 8556
31	5.53	0 9761			

See remarks under α Acetnaphthalide, page 13.

100 gms. pyridine dissolve 0.16 gm. α alanine at 20–25°. (Dehn, 1917.)

Solubility of d Alanine and of dl Alanine in Water at Different Temperatures.

(Pellini and Coppola, 1913)

Results for:

t°.	d Alanine. Gms d Alanine per 100 Gms H_2O	$d-l$ Alanine. Gms $d-l$ Alanine per 100 Gms H_2O.	Mixtures $d+l$ Alanine. Gms per 100 Gms H_2O. d Alanine	l Alanine.
0	12.99	12.89	13.27	4.01
17	15.17	14.95	14.5	4.1
30	17.39	17.72	17.05	4.99
45	20.55	21.58	...	...

ALBUMIN (Egg).

100 gms. H_2O dissolve 100 gms. egg albumin at 20–25°. (Dehn, 1917)
100 gms. pyridine dissolve 0.1 gm egg albumin at 20°–25°. "
100 gms. aq. 50% pyridine dissolve 6.29 gms. egg albumin at 20°–25°. (Dehn, 1917)

ALLANTOIN $C_4H_6N_4O_3$.

Solubility in Water.

(Titherly, 1911)

The author obtained results varying from 0.7 to 0.77 gms. allantoin per 100 gms. H_2O at 25°. The variations were considered to be due to slow decomposition of the compound.

ALIZARIN $C_{14}H_6O_2(OH)_2$.

Solubility in Water at Varying Temperatures.

(Huttig, 1914, Beilstein)

t°	25°	100°	250°.
Grams Alizarin per liter	0.000595	0.340	3.017

According to Dehn (1917), 100 gms. H_2O dissolve 0.04 gm. alizarin at 20°–25°.

Solubility of Alizarin in Aqueous Solutions of:

Ammonia at 25°. Gms NH_3 per Liter	Gms Alizarin per Liter.	Sodium Hydroxide at 25° (Huttig, 1914) Gms NaOH per Liter	Gms Alizarin per Liter	Solid Phase
0.160	0.132	0.427	1.159	$C_{14}H_8O_4$
4.025	0.228	1.050	3.820	$C_{14}H_8O_4 + C_{14}H_7O_4Na$

100 gms. 95% formic acid dissolve 0.10 gm. alizarin at 20.8°. (Aschan, 1913)

Alizarin is soluble in all proportions in pyridine and in aq. 50% pyridine at 20°–25°. (Dehn, 1917)

ALOIN.

Squires and Caines (1905) found the solubility of aloin in water at room temperature to be 0.83 gm. per 100 cc. and in 90% alcohol, 5.55 gms. per 100 cc.

According to Wester and Bruins (1914) 100 gms. trichloroethylene dissolve 0.013 gm. aloin at 15°.

ALUMINIUM BROMIDE $AlBr_3$.

SOLUBILITY IN SEVERAL ORGANIC SOLVENTS.

(Menschutkin, 1909 10)

(Determinations by Synthetic Method.)

In Benzene.

t°.	Gms $AlBr_3$ per 100 Gms Sat Sol.	Solid Phase
5.7 m. pt.	0	C_6H_6
4.5	10	"
3	20	"
1 8 Eutec.	27 4	$(C_6H_6+AlBr_3)$
10	35.3	$AlBr_3$
20	46 5	"
30	59	"
40	70	"
60	83	"
80	91.2	"
90	95 3	"
96	100	"

In Para Xylene.

t°.	Gms $AlBr_3$ per 100 Gms Sat Sol.	Solid Phase.
14 m. pt.	0	$p\ C_6H_4(CH_3)_2$
12.5	11.4	"
10 2 Eutec.	25	$AlBr_3+p\ C_6H_4(CH_3)_2$
20	35.7	$AlBr_3$
30	47.2	"
40	61 2	"
50	72 2	"
60	79 6	"
80	90.9	"
90	95 4	"
96	100	"

In Toluene.

t°	Gms $AlBr_3$ per 100 Gms Sat Sol.	Solid Phase.
−15	16 1	$AlBr_3$
0	23 7	"
10	32 1	"
20	42 5	"
30	56	"
40	68.8	"
50	76 5	"
70	87 2	"
90	95 7	"
96	100	"

In Benzoyl Chloride.

t°	Gms $AlBr_3$ per 100 Gms Sat Sol.	Solid Phase.
− 0 5 m. pt.	0	C_6H_5COCl
− 2 5	11 7	"
− 5 Eutec	22 2	$C_6H_5COCl+AlBr_3\ C_6H_5COCl$
20	33 7	$AlBr_3\ C_6H_5COCl$
40	42 6	"
60	51 6	"
80	60 5	"
90 m. pt.	65 5	"
80	68 9	"
60	71 8	"
30	75 8	"
7 Eutec.	78 8	$AlBr_3\ C_6H_5COCl+AlBr_3$
20	80 6	$AlBr_3$
50	85 6	"
80	93.2	"
96	100	"

Reciprocal solubilities determined by the method of lowering of the freezing-point (see footnote, page 1) are given by Kahlukow and Sachanow (1909) for mixtures of **Aluminium Bromide** and each of the following compounds: aniline, benzene, benzonitrile, methylbenzoate, *p* bromaniline, bromobenzene, methylene bromide, *p* dibromobenzene, dimethylaniline, diphenylamine, methylaniline, naphthaline, nitrobenzene, pyridine, toluene and *p* xylene. Similar data for mixtures of **Aluminium Bromide** and dimethylpyrone are given by Plotnikow (1911).

SOLUBILITY OF ALUMINIUM BROMIDE IN SEVERAL ORGANIC SOLVENTS (*Con.*)

(Determinations by Synthetic Method.)

In Benzophenone.

t°.	Gms $AlBr_3$ per 100 Gm Sat. Sol.	Solid Phase.
48 m. pt.	0	$(C_6H_5)_2CO$
45	12	"
42	19	"
38 Eutec.	24.7	" $+AlBr_3.(C_6H_5)_2CO$
60	30.9	$AlBr_3.(C_6H_5)_2CO$
80	36.4	"
100	42.2	"
120	49	"
130	53	"
142 m. pt.	59.5	"
130	64	"
100	69	"
70	72.2	"
50	74	"
38 Eutec.	75	" $+AlBr_3$
50	78	$AlBr_3$
80	88	"
90	93.5	"
96	100	"

In Ethylene Bromide.

t°.	Gms. $AlBr_3$ per 100 Gm. Sat. Sol.	Solid Phase.
10 m. pt.	0	$C_2H_4Br_2$
6	11.5	"
2	21.3	"
− 2 Eutec.	29.7	$C_2H_4Br_2+AlBr_3$
10	36.1	$AlBr_3$
20	42.1	"
30	48.7	"
40	56	"
50	63.7	"
60	71.5	"
70	79.1	"
80	86.8	"
90	94.5	"
96	100	"

In Nitrobenzene.

t°.	Gms $AlBr_3$ per 100 Gm. Sat. Sol	Solid Phase.
5.5 m. pt.	0	$C_6H_5NO_2$
0	18	"
−5	28.8	"
−15 Eutec.	42	" $+AlBr_3.C_6H_5NO_2$
0	44.3	$AlBr_3.C_6H_5NO_2$
30	49.4	"
60	56.7	"
80	63.6	"
87 m. pt.	68.4	"
80	71.3	"
60	73.9	"
40	76.4	"
20 Eutec.	78.9	" $+AlBr_3$
40	82.4	$AlBr_3$
60	85.8	"
80	89.8	"
93	96.6	"
96	100	"

In *o* Chloronitrobenzene.

t°.	Gms $AlBr_3$ per 100 Gm. Sat. Sol.	Solid Phase.
32.5 m. pt.	0	*o* $C_6H_4ClNO_2$
25	21.8	"
13.8 Eutec.	37.5	" $+AlBr_3.$*o* $C_6H_4ClNO_2$
30	43.1	$AlBr_3.$*o* $C_6H_4ClNO_2$
50	50.3	"
70	57.6	"
83.5 m. pt.	62.9	"
70	67	"
40	73.7	"
21 Eutec.	77.5	" $+AlBr_3$
40	80.6	$AlBr_3$
60	84	"
80	88.6	"
90	93.4	"
96	100	"

SOLUBILITY OF ALUMINIUM BROMIDE IN SEVERAL ORGANIC SOLVENTS (*Con.*).

(Determinations by Synthetic Method.)

In *m* Chloronitrobenzene.

t°.	Gms AlBr₃ per 100 Gms. Sat Sol.	Solid Phase.
44.5 m. pt.	0	*m* $C_6H_4ClNO_2$
40	18.9	"
35.5 Eutec.	27.8	" + $AlBr_3$ *m* $C_6H_4ClNO_2$
50	34.8	$AlBr_3$ *m* $C_6H_4ClNO_2$
70	44.5	"
90	54.5	"
103.5 m. pt.	62.9	"
90	68.6	"
70	73.4	"
50	77.3	"
40 Eutec.	79.1	" + $AlBr_3$
60	82.2	$AlBr_3$
80	87.1	"
90	92.2	"
95	95.1	"
96	100	"

In *p* Chloronitrobenzene.

t°.	Gms AlBr₃ per 100 Gms Sat Sol	Solid Phase.
83 m. pt.	0	*p* $C_6H_4ClNO_2$
80	9	"
70	24.8	"
60 Eutec.	36.6	" + $AlBr_3$ *p* $C_6H_4ClNO_2$
80	45.6	$AlBr_3$ *p* $C_6H_4ClNO_2$
100	54.9	"
115 m. pt.	62.9	"
100	66.8	"
60	72.4	"
20 Eutec.	78	" + $AlBr_3$
60	85.3	$AlBr_3$
80	89.3	"
93	95.4	"
96	100	"

In *o* Bromonitrobenzene.

t°.	Gms AlBr₃ per 100 Gms Sat Sol	Solid Phase
38 m. pt.	0	*o* $C_6H_4BrNO_2$
30	19.7	"
21 Eutec.	30	" + $AlBr_3$ *o* $C_6H_4BrNO_2$
40	37.6	$AlBr_3$ *o* $C_6H_4BrNO_2$
60	45.3	"
80	53	"
88.5 m. pt.	56.9	"
80	59.7	"
60	64.1	"
40	68.6	"
24 Eutec.	72	" + $AlBr_3$
40	75.5	$AlBr_3$
60	79.8	"
80	86.3	"
93	94.5	"
96	100	"

In *m* Bromonitrobenzene.

t°.	Gms AlBr₃ per 100 Gms Sat Sol.	Solid Phase.
54 m. pt.	0	*m* $C_6H_4BrNO_2$
50	11.6	"
45.5 Eutec.	19.5	" + $AlBr_3$ *m* $C_6H_4BrNO_2$
60	25.5	$AlBr_3$ *m* $C_6H_4BrNO_2$
80	34.5	"
110	49.5	"
122 m. pt.	56.9	"
110	61.6	"
80	69.2	"
60	74.1	"
42 Eutec.	78.7	" + $AlBr_3$
60	80.3	$AlBr_3$
80	84.9	"
93	93.6	"
96	100	"

SOLUBILITY OF ALUMINIUM BROMIDE IN SEVERAL ORGANIC SOLVENTS (*Con.*).

(Determinations by Synthetic Method.)

In *p* Bromonitrobenzene.

t°.	Gms $AlBr_3$ per 100 Gms Sat. Sol.	Solid Phase.
124.5 m. pt.	0	*p* $C_6H_4BrNO_2$
119	10	"
110	25.2	"
98 Eutec.	35.3	" $+AlBr_3.$*p* $C_6H_4BrNO_2$
110	39.7	$AlBr_3$ *p* $C_6H_4BrNO_2$
130	48.7	"
144 m. pt.	56.9	"
120	65.5	"
90	70.5	"
60	74.1	"
45 Eutec.	76	" $+AlBr_3$
60	79.6	$AlBr_3$
80	86.6	"
93	95.4	"
96	100	"

In *p* Nitrotoluene.

t°.	Gms $AlBr_3$ per 100 Gms Sat. Sol.	Solid Phase.
53.5 m. pt.	0	*p* $C_6H_4CH_3NO_2$
50	10	"
40	31.3	"
29 Eutec.	46.1	" $+AlBr_3$ *p* $C_6H_4CH_3NO_2$
50	52.9	$AlBr_3$ *p* $C_6H_4CH_3NO_2$
80	63	"
88 m. pt.	66	"
80	68.5	"
50	74.3	"
27 Eutec.	78.9	" $+AlBr_3$
50	83.3	$AlBr_3$
70	87.7	"
85	92.2	"
93	96.7	"
96	100	"

In *m* Nitrotoluene.

t°.	Gms $AlBr_3$ per 100 Gms Sat Sol.	Solid Phase.
16 m. pt.	0	*m* $C_6H_4CH_3NO_2$
12	14.5	"
8	21.8	"
1 Eutec.	32	" $+AlBr_3$ *m* $C_6H_4CH_3NO_2$
20	38.5	$AlBr_3$ *m* $C_6H_4CH_3NO_2$
40	46.6	"
80	59.7	"
90	63.3	"
96 m. pt.	66	"
90	68.8	"
60	73.8	"
27 Eutec.	78.9	" $+AlBr_3$
40	82	$AlBr_3$
70	89	"
90	95.3	"
96	100	"

In *o* Nitrotoluene.

t°.	Gms $AlBr_3$ per 100 Gms Sat Sol.	Solid Phase.
− 8.5 m. pt.	0	*o* $C_6H_4CH_3NO_2$
−11 Eutec.	8.7	" $+AlBr_3$ 2*o*$C_6H_4CH_3NO_2$
10	12.8	$AlBr_3$ 2*o*$C_6H_4CH_3NO_2$
30	24.8	"
40	38	"
42.5 Eutec.	47.7	" $+AlBr_3$ 2*o*$C_6H_4CH_3NO_2$
60	54.3	$AlBr_3$ *o* $C_6H_4CH_3NO_2$
75	59.5	"
90 m. pt.	66	"
70	72	"
40	76.1	"
19 Eutec.	79.1	" $+AlBr_3$
40	82.5	$AlBr_3$
70	87.5	"
90	93.8	"
96	100	"

ALUMINIUM CHLORIDE $AlCl_3.6H_2O$.

SOLUBILITY IN WATER.
(Gerlach — Z. anal. Ch. 8, 250, '69.)

100 gms. saturated solution contain 41.13 gms. $AlCl_3$ at 15°, Sp. Gr. of solution = 1.354.

SOLUBILITY OF ALUMINIUM CHLORIDE IN SEVERAL ORGANIC SOLVENTS.
(Menschutkin, 1909.)

(Determinations by Synthetic Method.)

In Nitrobenzene.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
5.5 m. pt.	0	$C_6H_5NO_2$
2 Eutec.	10.3	" $+AlCl_3.2C_6H_5NO_2$
15	18	$AlCl_3.2C_6H_5NO_2$
25.5 Eutec.	30.5	" $+AlCl_3.C_6H_5NO_2$
45	34.2	$AlCl_3.C_6H_5NO_2$
65	39.5	"
85	48	"
90 m. pt.	52	"
82	55.6	"
72	58	"
52 Eutec.	61.6	" $+AlCl_3$
90	64	$AlCl_3$
130	67.7	"
160	72.4	"
180	80.1	"
194	100	"

In *o* Chloronitrobenzene.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
32.5 m. pt.	0	*o* $C_6H_4ClNO_2$
27	10.2	"
21	16.1	"
15 Eutec.	20.3	" $+AlCl_3.o\,C_6H_4ClNO_2$
35	25.5	$AlCl_3.o\,C_6H_4ClNO_2$
55	31.5	"
75	38.7	"
89 m. pt.	45.9	"
80	51	"
69 Eutec.	54.4	" $+AlCl_3$
110	57.5	$AlCl_3$
150	65.4	"
175	74.6	"
194	100	"

In *m* Chloronitrobenzene.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
44.5 m. pt.	0	*m* $C_6H_4ClNO_2$
44	10.7	"
36 Eutec.	16.6	" $+AlCl_3.m\,C_6H_4ClNO_2$
50	21	$AlCl_3.m\,C_6H_4ClNO_2$
70	28.3	"
90	36.8	"
104 m. pt.	45.9	"
90	52.4	"
81 Eutec.	55.6	" $+AlCl_3$
120	60	$AlCl_3$
140	64.1	"
160	70.2	"

In *p* Chloronitrobenzene.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
83.5 m. pt.	0	*p* $C_6H_4ClNO_2$
78	7.1	"
73	12.8	"
68 Eutec.	17.1	" $+AlCl_3.p\,C_6H_4ClNO_2$
80	22.2	$AlCl_3.p\,C_6H_4ClNO_2$
100	31.4	"
120	41.8	"
126 m. pt.	45.9	"
110	53.2	"
94 Eutec.	58.1	" $+AlCl_3$
125	60.5	$AlCl_3$
155	66.9	"
180	77.7	"
190	88.2	"
194	100	"

The solubility of aluminium chloride in anhydrous hydrazine is stated by Welsh and Broderson (1915) to be 1.0 gm. in 100 cc. at room temperature.

ALUMINIUM CHLORIDE

SOLUBILITY IN SEVERAL ORGANIC SOLVENTS (*Con.*).

(Determinations by Synthetic Method.)

In *o* Bromonitrobenzene.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
38.5	0	*o* $C_6H_4BrNO_2$
32	7.5	"
26	13.1	"
20 Eutec.	17.5	" $+AlCl_3$ *o* $C_6H_4BrNO_2$
40	21.7	$AlCl_3$ *o* $C_6H_4BrNO_2$
60	26.4	"
80	31.7	"
97 m. pt.	38	"
100	39.8	"
90	44.6	"
80 Eutec.	46.5	" $+AlCl_3$
110	50.1	$AlCl_3$
130	54.1	"
150	60.2	"
170	70	"
180	77.4	"

In *m* Bromonitrobenzene.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
54.7	0	*m* $C_6H_4BrNO_2$
51	6.5	"
47 Eutec.	11.9	" $+AlCl_3$ *m* $C_6H_4BrNO_2$
60	16	$AlCl_3$ *m* $C_6H_4BrNO_2$
80	22.9	"
100	30.7	"
110	35.9	"
116 m. pt.	39.8	"
113	42.3	"
107	44.5	"
97 Eutec.	47.4	" $+AlCl_3$
120	51.5	$AlCl_3$
140	56.5	"
160	64.5	"
180	77.4	"
190	88.8	"
197	100	"

In *p* Bromonitrobenzene.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
124.5 m. pt.	0	*p* $C_6H_4BrNO_2$
117	7.4	"
111	12.8	"
105	17.7	"
99 Eutec.	22.2	" $+AlCl_3$ *p* $C_6H_4BrNO_2$
120	28.4	$AlCl_3$ *p* $C_6H_4BrNO_2$
140	36.4	"
145 m. pt.	39.8	"
140	44.5	"
120	51.2	"
113 Eutec.	52.8	" $+AlCl_3$
130	55.9	$AlCl_3$
150	61.3	"
180	77.4	"
190	88.8	"
194	100.0	"

In *o* Nitrotoluene.

t°.	Gms. $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−8.5 m. pt.	0	*o* $C_6H_4CH_3NO_2$
−9.3 Eutec.	1	" $+AlCl_3$ 2*o* $C_6H_4CH_3NO_2$
0	1.5	$AlCl_3$ 2*o* $C_6H_4CH_3NO_2$
20	4	"
40	11	"
55 Eutec.	31	" $+AlCl_3$ *o* $C_6H_4CH_3NO_2$
85	41.8	$AlCl_3$.*o* $C_6H_4CH_3NO_2$
95.5 m. pt.	49.3	"
70	56.8	"
45 Eutec.	61.5	" $+AlCl_3$
95	64.5	$AlCl_3$
145	73.7	"
180	86.2	"
185	89.5	"
194	100	"

One liter sat. solution of $AlCl_3$ in CCl_4 contains 0.74 gm. at 4°, 0.22 gm. at 14°, 0.15 gm. at 20° and 0.06 gm. at 34°.

One liter sat. solution of $AlCl_3$ in $CHCl_3$ contains 0.65 gm. at −15°, 1.0 gm at 0° and 0.72 gm. at 25°. (Lloyd, 1918.)

SOLUBILITY IN SEVERAL ORGANIC SOLVENTS (*Con.*).

(Determinations by Synthetic Method.)

In *m* Nitrotoluene.

t°.	Gms $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
16 m. pt.	0	*m* $C_6H_4CH_3NO_2$
13 Eutec.	7.8	" + $AlCl_3$ 2*m* $C_6H_4CH_3NO_2$
27	13.4	$AlCl_3$ 2*m* $C_6H_4CH_3NO_2$
35 Eutec.	24.5	" + $AlCl_3$ *m* $C_6H_4CH_3NO_2$
65	34	$AlCl_3$ *m* $C_6H_4CH_3NO_2$
90	44.2	"
95	46.7	"
99.5 m.pt.	49.3	"
70	56.8	"
45 Eutec.	61.5	" + $AlCl_3$
95	64.5	$AlCl_3$
120	68.2	"
130	70.2	"

In *p* Nitrotoluene.

t°.	Gms $AlCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
52.5 m. pt.	0	*p* $C_6H_4CH_3NO_2$
47	9.2	"
42	15	"
37 Eutec.	19	" + $AlCl_3$ *p* $C_6H_4CH_3NO_2$
55	29.1	$AlCl_3$ *p* $C_6H_4CH_3NO_2$
80	34.8	"
95	41.3	"
109 m. pt.	49.3	"
100	53.4	"
60	61.7	"
45 Eutec.	64	" + $AlCl_3$
105	69.5	$AlCl_3$
165	80	"
190	94.3	"
194	100.0	"

In Benzophenone.

t°.	Gms $AlCl_3$ per 100 Gms Sat Sol.	Solid Phase.
48 m. pt.	0	$(C_6H_5)_2CO$
44	8.5	"
39.5 Eutec.	15.4	" + $AlCl_3(C_6H_5)_2CO$
60	19.3	$AlCl_3$ $(C_6H_5)_2CO$
90	26.5	"
120	37	"
130 m. pt.	42.3	"
110	48.8	"
80	53.5	"
60 Eutec.	56.1	" + $AlCl_3$
100	58	$AlCl_3$
140	63	"
160	68.6	"
180	78.5	"
190	89.1	"
192	93	"
194	100	"

In Benzoyl Chloride.

t°.	Gms $AlCl_3$ per 100 Gms. Sat Sol	Solid Phase.
−0.5 m. pt.	0	C_6H_5COCl
−4	7.9	"
−7.5 Eutec.	12.7	" + $AlCl_3$ C_6H_5COCl
0	14.1	$AlCl_3$ C_6H_5COCl
20	18.8	"
40	25	"
60	33	"
80	42.2	"
93 m. pt.	48.7	"
80	52.9	"
60	57.2	"
40	61	"

ALUMINIUM FLUORIDE AlF_3.

Fusion-point data (Solubility, see footnote, page 1) are given by Pushin and Baskov (1913) for the following mixtures:

$AlF_3 + NaF$, $AlF_3 + KF$, $AlF_3 + LiF$, $AlF_3 + CsF$, $AlF_3 + RbF$.

Similar data for mixtures of $AlF_3 + NaF$ are given by Fedotieff and Illjinsky (1913).

ALUMINIUM HYDROXIDE $Al(OH)_3$.

SOLUBILITY OF MOIST FRESHLY PRECIPITATED ALUMINIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF ALUMINIUM SULPHATE.

(Kremann and Huttinger, 1908)

Results at 20°.

Gms per 100 Gms H_2O $Al_2(SO_4)_3$.	Gms per 100 Gms H_2O $Al(OH)_3$	Solid Phase
2.37	0 15	$Al_2O_3.SO_3.9H_2O$
5	0 30	"
7	0.65	"
9.1	1.30	Transition Point
10	1 23	$Al_2O_32SO_3.12H_2O$
15	1 04	"
20	1 40	"
25	2 40	"
30	3.70	"
31 6	4 20	Transition Point
33	2 75	$Al_2O_3.3SO_3.16H_2O$
34 73	0 92	"

Results at 40°.

Gms per 100 Gms H_2O $Al_2(SO_4)_3$	Gms per 100 Gms H_2O $Al(OH)_3$.	Solid Phase.
5 22	1.33	$Al_2O_3.SO_3.9H_2O$
...	...*	Transition Point
8.85	1 82	$Al_2O_3.2SO_312H_2O$
10	1 65	"
15	1 40	"
20	2 15	"
25	3 80	"
28 5	5 80	Transition Point
30	4 35	$Al_2O_3.3SO_3.16H_2O$
35	1 60	"
49	0 60	"

Results at 60°.†

Gms per 100 Gms H_2O $Al_2(SO_4)_3$	Gms per 100 Gms H_2O $Al(OH)_3$	Solid Phase
3 24	0 75	$Al_2O_3.SO_3.9H_2O$
8 83	2 53	$Al_2O_3.2SO_3.12H_2O$
12 67	1 85	"
24 07	3 14	"
31 55	4 89	"
42 38	6.02	$Al_2O_3.3SO_3.16H_2O$
49 85	1 42	"

* The figures given are not sufficient to determine this transition point accurately.

† The author's figures for 60° are reproduced without change as they are not sufficient to determine transition points

SOLUBILITY OF ALUMINIUM HYDROXIDE IN AQUEOUS SODIUM HYDROXIDE SOLUTIONS. (Haber and van Oordt, 1904)

The mixtures were agitated for 24 hours. So-called acetic acid soluble *tonerde* (E. Merck) was used for the experiments. Temp. 20°-23°.

Normality of Aq NaOH	Gms Al_2O_3 per Liter
0 49	9 27
0 99	13 90
2.00	14 40

SOLUBILITY OF ALUMINIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE. (Herz, 1911, Slade, 1911 and 1912)

The experiments show that the ratio of Na to Al in the solution varies considerably depending upon whether the used Al hydroxide was precipitated hot or cold, also upon the length of time it was dried and upon the nature of the drying agent. Herz found a nearly constant ratio of 3 Na to 1 Al in solution. Slade gives ratios of approximately 2 5 : 1 in normal NaOH at 25° for cold precipitated hydroxide dried over H_2SO_4 and 9.0 1 for hot precipitated Al hydroxide dried over P_2O_5 Drying in thin layers also increased this ratio but to a somewhat less extent. Slade reports the solubility of $Al(OH)_3$ in a 0.6414 normal NaOH solution to be 1 34 gm. per 100 cc. at room temperature.

ALUMINIUM OXIDE Al_2O_3.

Fusion-point lowering data for mixtures of aluminium oxide and cryolite are given by Lorenz, Jabs and Eitel (1913). The results show one eutectic at approximately 940°. The eutectic mixture contains 19 8% Al_2O_3.

Results for aluminium oxide and magnesium oxide are given by Rankin and Merwin (1916).

ALUMINIUM SULFATE $Al_2(SO_4)_3.18H_2O$.

SOLUBILITY IN WATER.

(Poggiale, 1843; Kremann and Huttinger, 1908.)

t°	Gms $Al_2(SO_4)_3$ per 100 Gms. Sat. Sol.	Solid Phase	t°	Gms. $Al_2(SO_4)_3$ per 100 Gms. Sat. Sol.	Solid Phase
− 1.02	8.09	Ice	20	26.7	$Al_2(SO_4)_3.18H_2O$
− 1.43	10.7	"	30	28.8	"
− 2.04	14.3	"	40	31.4	"
− 2.65	17.5	"	50	34.3	"
− 2.85	19.2	"	60	37.2	"
− 4 Eutec.	23.1	Ice + $Al_2(SO_4)_3.18H_2O$	70	39.8	"
0	23.8	$Al_2(SO_4)_3.18H_2O$	80	42.2	"
+ 7.73	24.8	"	90	44.7	"
10	25.1	"	100	47.1	"

SOLUBILITY OF ALUMINIUM SULFATE IN AQUEOUS SOLUTIONS OF FERRIC SULFATE AT 25° AND VICE VERSA. (Wirth and Bakke, 1914.)

Gms. per 100 Gms. Sat. Sol. $Al_2(SO_4)_3$	$Fe_2(SO_4)_3$	Solid Phase	Gms. per 100 Gms. Sat. Sol. $Al_2(SO_4)_3$	$Fe_2(SO_4)_3$	Solid Phase
27.82	0	$Al_2(SO_4)_3.18H_2O$	10.03	32.42	$Fe_2(SO_4)_3.9H_2O$
26.01	6.064	"	8.819	34.02	"
24.21	9.819	"	6.626	35.82	"
21.64	13.02	"	5.200	38.83	"
15.22	23.28	"	2.342	42.44	"
10.46	31.90	" + $Fe_2(SO_4)_3.9H_2O$	. .	44.97	"

EQUILIBRIUM BETWEEN ALUMINIUM SULFATE, LITHIUM SULFATE, AND WATER AT 30°. (Schreinemaker and De Waal, 1906.)

Composition in Weight per cent. Of Solution: % Li_2SO_4	% $Al_2(SO_4)_3$	Of Residue: % Li_2SO_4	% $Al_2(SO_4)_3$	Solid Phase.
25.1	0	. .	. .	$Li_2SO_4.H_2O$
21.93	5.34		.	"
16.10	14.89	63.70	4.02	"
13.63	20.76	14.72	31.17	$Li_2SO_4.H_2O$ + $Al_2(SO_4)_3.18H_2O$
13.24	21.71	61.24	7.22	$Li_2SO_4.4H_2O$
11.73	22.08	6.92	33.54	$Al_2(SO_4)_3.18H_2O$
6.75	24.34	3.77	37.06	"
3.44	26.12		. .	"
0.0	28.0	.		"

SOLUBILITY OF ALUMINIUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°. (Wirth, 1912.)

Gms. per 100 Gms. Sat. Sol. $Al_2(SO_4)_3$.	H_2SO_4	Solid Phase	Gms. per 100 Gms. Sat. Sol. $Al_2(SO_4)_3$.	H_2SO_4	Solid Phase
27.82	0	$Al_2(SO_4)_3.18H_2O$	4.8	40	$Al_2(SO_4)_3.18H_2O$
29.21	5.13	"	1.5	50	"
26.2	10	"	1	60	"
19.5	20	"	2.3	70	"
11.6	30	"	4	75	"

A curve was plotted from the published results and the above figures read from the curve.

100 gms. glycol dissolve 16.82 gms. $Al_2(SO_4)_3$. (de Coninck, 1905.)

ALUMINIUM SULFIDE Al_2S_3.

Fusion-point data for mixtures of Al_2S_3 + Ag_2S are given by Cambi (1912).

ALUMS.

Solubility of Ammonium Alum and of Potassium Alum in Water.

(Mulder; Poggiale — Ann. chim. phys [3] 8, 467, '43; Locke — Am Ch J 26, 174, '01; Marino — Gazz. chim. ital 35, II, 351, '05; Berkeley — Trans Roy Soc 203 A, 214, '04.)

t°.	Ammonium Alum. Gms. $(NH_4)_2Al_2(SO_4)_4$ per 100 g. H_2O.	Gms. $(NH_4)_2Al_2(SO_4)_4 24H_2O$ per 100 g. H_2O.	G M $(NH_4)_2Al_2(SO_4)_4$ per 100 g. H_2O.	Potassium Alum. Gms $K_2Al_2(SO_4)_4$ per 100 g. H_2O.	Gms. $K_2Al_2(SO_4)_4 24H_2O$ per 100 g. H_2O.	G. M $K_2Al_2(SO_4)_4$ per 100 g. H_2O.
0	2.10	3 90	0.0044	3.0	5.65	0.0058
5	3.50	6 91	0 0074	3.5	6.62	0 0068
10	4 99	9 52	0 0105	4.0	7 60	0 0077
15	6 25	12 66	0 0132	5.0	9 59	0 0097
20	7 74	15 13	0 0163	5.9	11 40	0 0114
25	9 19	19 19	0.0194	7 23	14 14	0 0140
30	10 94	22 01	0 0231	8 39	16 58	0 0162
40	14 88	30 92	0 0314	11.70	23.83	0 0227
50	20.10	44 10	0.0424	17 00	36 40	0 0329
60	26.70	66.65	0 0569	24 75	57.35	0 0479
70	...	...	...	40.0	110.5	0 0774
80	...	...	...	71.0	321 3	0 1374
90	...	...	...	109.0	2275 0	0.2110
92.5	...	...	...	119.0	∞	0.2313
95	109.7	∞	0.2312	...	...	...

Note. — The potassium alum figures in the preceding table were taken from a curve plotted from the closely agreeing determinations of Mulder, Locke, Berkeley, and Marino. For the higher temperatures (above 60°), however, the results of Marino are lower than those of the other investigators, and are omitted from the average curve.

Locke called attention in his paper to the fact that Poggiale's results upon ammonium and potassium alum had evidently become interchanged through some mistake. This explanation is entirely substantiated, not only by Locke's determinations, but also by those of Mulder and Berkeley. The ammonium alum figures given above were therefore read from Poggiale's potassium alum curve, with which Locke's determination of the solubility of ammonium alum at 25° is in entire harmony.

Solubility of Ammonium Alum in Presence of Ammonium Sulfate and in Presence of Aluminium Sulfate in Water.

(Rudorff — Ber. 18, 1160, '85.)

Mixture Used.	100 Gms. Saturated Solution Contain: Grams $(NH_4)_2SO_4$	+ Grams $Al_2(SO_4)_3$
Saturated Ammonium Alum at 18.5°	1.42	3.69
20 cc. above sol. + 6 gms. cryst. $Al_2(SO_4)_3$	0 45	16.09
20 cc. above sol. + 4 gms. cryst. $(NH_4)_2SO_4$	20.81	0.29

Solubility of Mixtures of Potassium Alum and Aluminium Sulfate and of Potassium Alum and Potassium Sulfate in Water.

(Marino — Gazz. chim. ital. 35, II, 351, '05.)

t°.	Gms. per 1000 Gms. H_2O: $Al_2(SO_4)_3.18H_2O$.	Gms. per 1000 Gms. H_2O: K_2SO_4.	Gm. Mols. per 1000 Mols. H_2O: $Al_2(SO_4)_3.18H_2O$.	Gm. Mols. per 1000 Mols. H_2O: K_2SO_4.	Solid Phase.
0	243.73	23.45	6.1	2.3	$K_2Al_2(SO_4)_4.24H_2O + Al_2(SO_4)_3$
20	824.25	30.85	15.1	3.1	
35	911.02	35.29	24.1	3.6	"
50	1243.21	59.55	33.5	6.1	"
65	1598.00	119.43	43.1	12.6	"
77	1872.11	183.80	50.5	18.9	"
0	5.06	75.83	0.1	7.8	$K_2Al_2(SO_4)_4.24H_2O + K_2SO_4$
0.5	8.66	75.18	0.2	7.7	
5.	16.07	85.78	0.4	8.8	"
10	18.52	96.50	0.5	9.9	"
15	20.56	109.30	0.55	11.2	"
30	39.60	147.8	1.0	15.2	"
40	73.88	163.1	1.9	16.8	"
50	126.0	195.4	3.4	20.1	"
60	249.7	238.8	6.7	24.6	"
70	529.0	323.7	14.2	32.6	"
80	1044.0	517.27	28.1	53.4	"

Solubility of Mixtures of Potassium Alum and of Thallium Alum in Water at 25°.

(Fock — Z. Kryst. Min. 28, 397, '97.)

$$K_2Al_2(SO_4)_4.24H_2O;\ Tl_2Al_2(SO_4)_4.24H_2O.$$

Composition of Solution: $KAl(SO_4)_2$ per Liter, Grams.	$KAl(SO_4)_2$ per Liter, Mg. Mols.	$TlAl(SO_4)_2$ per Liter, Grams.	$TlAl(SO_4)_2$ per Liter, Mg. Mols.	Mol. % $KAl(SO_4)_2$.	Sp. Gr. of Solutions.	Solid Phase Mol. % of Potassium Alum.
69.90	270.5	0.00	0.00	100	1.0591	100.0
74.56	288.2	0.48	1.13	99.61	1.0601	99.32
67.90	262.8	1.72	4.07	98.48	1.0598	96.84
65.30	252.7	4.52	10.67	95.95	1.0603	90.84
64.95	251.4	9.60	22.67	91.73	1.0605	82.94
53.23	205.9	18.44	43.56	82.54	1.0609	68.24
45.32	175.4	24.60	58.10	75.12	1.0609	58.23
38.02	147.2	32.48	76.75	65.73	1.0611	46.72
34.54	133.6	35.59	84.10	61.36	1.0611	44.23
28.35	109.7	42.99	101.60	51.93	1.0623	32.07
10.94	42.4	66.12	156.2	21.34	1.0654	7.94
0.00	0.0	75.46	178.3	0.00	1.0674	0.00

Data for the influence of pressure on the solubility of potassium alum in water at 0° are given by Stackelberg, 1896.

Data for the solubility of Rubidium Alums are given on p. 582.

SOLUBILITY OF SODIUM ALUM IN WATER.
(Smith, 1909)

t°.	Gms $Na_2Al_2(SO_4)_4$ per 100 Gms Sat Sol	Water	t°	Gms $Na_2Al_2(SO_4)_4\ 24H_2O$ per 100 Gms Sat Sol	Water
10	26.9	36.7	10	50.8	103.1
15	27.9	38.7	15	52.7	111.3
20	29	40.9	20	54.8	121.4
25	30.1	43.1	25	56.9	131.8
30	31.4	45.8	30	59.4	146.3

Above 30°, sodium alum is decomposed in contact with its saturated solution. The exact temperature of transition has not been determined.

Single determinations differing from the above are given by Tilden (1884) and by Auge (1890).

SOLUBILITY OF CAESIUM ALUM, RUBIDIUM ALUM, AND OF THALLIUM ALUM IN WATER.

(Setterburg — Liebig's Annalen, 211, 104, '82, Locke — Am Ch J 26, 183, '01, Berkeley — Trans. Roy. Soc 203 A, 215, '04)

t°.	Caesium Alum Gms per 100 Gms H_2O $Al_2Cs_2(SO_4)_4$.	$Al_2Cs_2(SO_4)_4\cdot 24H_2O$.	Rubidium Alum Gms per 100 Gms H_2O $Al_2Rb_2(SO_4)_4$.	$Al_2Rb_2(SO_4)_4\ 24H_2O$.	Thallium Alum Gms per 100 Gms H_2O. $Al_2Tl_2(SO_4)_4$.	$Al_2Tl_2(SO_4)_4\ 24H_2O$
0	0.21	0.34	0.72	1.21	3.15	4.84
5	0.25	0.40	0.86	1.48	3.80	5.86
10	0.30	0.49	1.05	1.81	4.60	7.12
20	0.40	0.65	1.50	2.59	6.40	10.00
25	0.50	0.81	1.80	3.12	7.60	11.95
30	0.60	0.97	2.20	3.82	9.38	14.89
40	0.85	1.38	3.25	5.69	14.40	23.57
50	1.30	2.11	4.80	8.50	22.50	38.41
60	2.00	3.27	7.40	13.36	35.36	65.19
70	3.20	5.27	12.40	23.25	...	...
80	5.40	9.01	21.60	43.25	...	..
90	10.50	18.11	..	...	...	...
100	22.70	42.54	..	...	...	...

NOTE. — Curves were plotted from the closely agreeing determinations recorded by the above named investigators and the table constructed from the curves.

Recent determinations of the solubility of caesium alum in water, by Hart and Huselton (1914), agree well with the data in the above table. For additional caesium alums see page 180.

SOLUBILITY OF **Ammonium Chromium Alum** IN WATER.
(Koppel, 1906)

It was shown that, due to the transition between the violet and green forms of the compound, the saturation point is reached very slowly, especially at the higher temperatures. From the determinations at 0° it was found that equilibrium is reached in 2½ hours. If this saturation time is taken for the other temperatures, the results are considered to show the solubility of the violet form alone. The final saturation represents the attainment of an equilibrium between the violet and green forms.

Results for the Violet Form. t°.	Time of Saturation, Hrs	Gms $(NH_4)Cr(SO_4)_2$ per 100 Gms Sol.	Results for Final Equilibrium. t°.	Time of Saturation, Hrs	Gms $(NH_4)Cr(SO_4)_2$ per 100 Gms Sol.
0	2.5	3.8	0	2.5	3.8
30	2.5	10.6	30	300	15.7–16
40	2.5	15.5	40	250	24.5–24.8

AMMONIA NH_3.

SOLUBILITY OF AMMONIA IN WATER.

(Roscoe and Dittmar — Liebig's Annalen, 112, 334, '59. Raoult — Ann. chim. [5] 1, 262, '74, Mallet — Am Ch J. 19, 807, '97.)

t°.	At 760 mm Pressure. G NH_3 per 100 g. H_2O.	At 760 mm Pressure. Vol NH_3 per 1 g. H_2O.	t°.	At 760 mm. Pressure. G NH_3 per 100 g. H_2O.	At 760 mm. Pressure. Vol NH_3 per 1 g. H_2O.
−40	294 6	...	20	52 6	710
−30	278 1	...	25	46 0	635
−20	176 8	...	30	40 3	595 (28°)
−10	111 5	...	35	35 5	...
0	87 5	1299	40	30.7	...
5	77 5	1019	45	27 0	...
10	67 9	910	50	22 9	...
15	60.0	802	56	18 5	...

SOLUBILITY OF AMMONIA IN WATER DETERMINED BY METHOD OF LOWERING OF FREEZING-POINT.

(Rupert, 1910)

t°	Gms NH_3 per 100 Gms Sol	Solid Phase.	t°	Gms NH_3 per 100 Gms Sol.	Solid Phase
0	0	Ice	−80 6	52	NH_3H_2O
− 2	2	"	−82 8	54	"
− 4 6	4	"	−85 8	56	"
− 7 6	6	"	−87 Eutec.	56 5	$NH_3H_2O + 2NH_3H_2O$
− 10 6	8	"	−84 8	58	$2NH_3H_2O$
− 13 9	10	"	−82.2	60	"
− 17 6	12	"	−80 4	62	"
− 21 4	14	"	−79 2	64	"
− 25 8	16	"	−79 8 m. pt.	66	"
− 31 3	18	"	−79 2	68	"
− 37	20	"	−80 3	70	"
− 43 6	22	"	−82 1	72	"
− 50 7	24	"	−84 5	74	"
− 60 3	26	"	−87 4	76	"
− 72 2	28	"	−90 4	78	"
− 87 2	30	"	−93 6	80	"
−102 3	32	"	−94 Eutec.	80 3	$2NH_3H_2O + NH_3$
−116 7	34	"	−91 7	82	NH_3
−120 Eutec.	34.5	Ice + NH_3H_2O	−89 4	84	"
−103 8	36	NH_3H_2O	−87 4	86	"
− 92 9	38	"	−85 6	88	"
− 86 7	40	"	−84 1	90	"
− 83 5	42	"	−82 7	92	"
− 81 4	44	"	−81 5	94	"
− 80	46	"	−80 3	96	"
− 79.3	48 7	"	−79 1	98	"
− 79 4	50	"	−78	100	"

More recent data on the above system, by Smits and Postma (1914) agree quite closely with the above except in the region of the eutectic Ice + NH_3H_2O. These authors report a temperature of −100 3 instead of −120 for this point. Additional determinations are also given by Baumé and Tykociner (1914). Older data for the ice curve are given by Guthrie (1884) and Pickering (1893).

Vapor Pressure of Aqueous Ammonia Solutions.

(Perman, 1903)

Gms NH_3 per 100 Gms Sol.	Vapor Pressure in mm of Mercury at: 0°.	10°.	20°.	30°	40°.	50°.	60°.
0	4.5	9	17.5	31.5	55	125	149.5
2.5	13	18	32.5	56.5	91	146	234
5	20	27	47.5	83	134.5	210	327
7.5	27.5	40	70	115	183.5	281	425
10	35	54	93	153.5	241.5	363.5	539.5
12.5	45	69	118	193.5	303.5	455	666
15	57.5	89	151	245	377.5	564	816.5
17 5	75	115	191	305.5	465.5	688.5	985
20	93	144	237	393	569 5	834.5	1191
22.5	117	180 5	291	455 5	690	1005	1432
25	144.5	226.5	360	561.5	830 5	1195	...
27 5	181	280	440	680	1007	...	...
30	222	346	537	817	1189 5	...	...

The apparatus (Perman, 1901) used for the above determinations, consisted of a pipet provided with a stop-cock at its upper end and connected with a Hg leveling tube at its lower end. For maintaining constant temperatures the vessel was surrounded by a glass jacket into which water or vapors of liquids boiling at various temperatures could be introduced. The aqueous ammonia solution was drawn in above the Hg and boiled to expel air A portion of it was withdrawn for analysis through the stop-cock at the top, by elevating the level of Hg The vapor pressures of the analyzed mixture at various constant temperatures were then read with the aid of an adjacent millimeter scale. Curves were plotted from the results and readings for regular intervals of concentration and temperature made

By means of a modification of the above apparatus the author was also able to estimate the partial pressure of the ammonia and of the water of each mixture. Tables for these values are given. Data have also been calculated for the latent heat of evaporation of aqueous ammonia solutions.

Influence of Salts and Other Compounds on the Vapor Pressure of Aqueous Ammonia Solutions.

(E G Perman, J Chem Soc (Lond), 81, 480, 1902)

Vapor pressure determinations were made as above described on aqueous solutions of the following compositions — (*a*) 10 43% Urea + 16.36% NH_3, (*b*) 5.29% Urea + 17 22% NH_3, (*c*) 4 56% Mannitol + 12 27% NH_3, (*d*) 3.05% K_2SO_4 + 7 49% NH_3, (*e*) 5 27% NH_4Cl + 16 85% NH_3, (*f*) 10 26% NH_4Cl + 12.9% NH_3, (*g*) 2 68% $CuSO_4$ + 14.65% NH_3, (*h*) 3 94% $CuSO_4$ + 6.54% NH_3.

The author's data were plotted on cross section paper and the following values read from the curves.

t°.	Vapor Presure of Each Solution in mm of Mercury. (*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)	(*g*)	(*h*)
20	204	200	120	...	193	130	155	...
30	325	325	198	...	302	220	235	87
40	485	500	311	200	471	345	365	145
50	715	727	465	304	695	522	545	223
60	1050	1060	705	453	975	770	...	344

In an earlier paper Perman (1901) gives data similar to the above for the vapor pressure of ammonia in aqueous solutions of sodium sulfate.

Mutual Solubility of Aqueous Ammonia and Potassium Carbonate Solutions.

(Newth — J. Chem. Soc 77, 776, 1900.)

The solutions used were: Potassium Carbonate saturated at 15° (contained 57.2 grams K_2CO_3 per 100 cc). Aqueous Ammonia of 0.885 Sp. Gr. (contained about 33 per cent ammonia). The determinations were made by adding successive small quantities of one of the solutions to a measured volume of the other, and observing the point at which opalescence appeared.

t°.	Saturated K_2CO_3 in Aq Ammonia		Aq. Ammonia in Saturated K_2CO_3	
	cc. K_2CO_3 per 100 cc. Ammonia.	% K_2CO_3 Solution in Mixture.	cc Ammonia in 100 cc. K_2CO_3.	% K_2CO_3 Solution in Mixture.
1	2.0	2 0	37 5	72 7
6	3 0	3 0	47 5	67 6
11	5 0	4 7	52 5	65 0
16	6 5	6 1	60 0	63 0
21	8 5	8 0	77 5	56 3
26	10 5	9 5	105 0	49 0
31	12 5	11.1	152 5	39 0
38	20 0	16 6	195 0	33 0
39	21 0	17 0	220 0	31 0
42	25.0	20 0	250 0	28 5
43	35.0	26 0	285 0	26 5

Above 43° the solutions are completely miscible. If 10 per cent of water is added to each solution the temperature of complete miscibility is lowered to 25°. The mutual solubilities are:

t°.	Per cent K_2CO_3 Solution in: Ammonia Layer	K_2CO_3 Sol. Layer.
0	8	62
10	11	52
20	15	38
25 (crit. pt.)	25	

With the addition of 12 9 per cent of water to each solution the temperature of complete miscibility (crit. pt) is lowered to 10°. With the addition of 18.1 per cent water this temperature becomes 0°.

Solubility of Ammonia in Aqueous Salt Solutions.

(Raoult.)

t°.	In Calcium Nitrate Solutions Gms NH_3 per 100 Gms Solvent in. 28 38% $Ca(NO_3)_2$	In 59.03% $Ca(NO_3)_2$.	In Potassium Hydroxide Solutions Gms NH_3 per 100 Gms Solvent in 11 25% KOH.	25 25% KOH.
0	96 25	104 5	72 0	40.5
8	78 50	84 75	57 0	37 5
16	65 00	70 5	46 0	28.5
24	.	.	37 3	21 8

The freezing-point curve for mixtures of ammonia and ammonium thiocyanate is given by Bradley and Alexander (1912).

Solubility of Ammonia in Aqueous Salt Solutions at 25°.

(Abegg and Riesenfeld, 1902)

The determinations were made by the dynamic method of vapor pressure measurement previously used by Doyer (1890), Konowalow (1898), Gahl (1900), and Gaus (1900). It consists in passing an indifferent gas through an aqueous ammonia solution of known concentration and calculating the vapor pressure from the volume of indifferent gas required to remove a definite amount of ammonia from solution. The indifferent gas (H + O) was generated by an electric current and its volume measured by means of a voltmeter. The accompanying ammonia was removed by passing through 0.01 n. HCl and estimated by means of electrolytic conductivity. The molecular vapor pressure was obtained by dividing the absolute vapor pressure, calculated from above measurements, by the concentration (normality) of the ammonia For 1 n. ammonia in water at 25° the molecular vapor pressure was 13.45 mm. Hg; for 0.5 n. solution it was 13.27 mm Hg.

Since it has been shown by much experimental evidence, that Henry's Law of the proportionality of the concentration in the liquid and vapor phase applies very closely in the present case, see also Gaus (1900), it follows that the ammonia pressure relation of two solutions of equal ammonia content is reciprocally proportional to the solubility relation of the ammonia in them. Hence, to calculate the solubility from the vapor pressures, it is only necessary to divide the value for the molecular vapor pressure in H_2O by that for the salt solution. Thus the solubility of NH_3 in H_2O becomes unity. All determinations were made with 1 n. aqueous ammonia in salt solution of 0.5, 1 and 1.5 normality. The figures therefore show mols. NH_3 per liter of the particular salt solution at 25°. In a later paper by Riesenfeld (1903), additional determinations are given for 35°.

Salt Solution	Mols NH₃ per Liter Salt Sol of			Salt Solution	Mols NH₃ per Liter Salt Sol of		
	0.5 n	1 n	1.5 n		0.5 n	1 n	1.5 n
KCl	0.930	0.866	0.809	KCN	0.926	0.858	0.802
KBr	0.950	0.904	0.857	KCNS	0.932	0.868	0.814
KI	0.970	0.942	0.900	K_2SO_4	0.875	0.772	0.678
KOH	0.852	0.716	0.607	K_2SO_3	0.865	0.768	0.675
NaCl	0.938	0.889	0.843	K_2CO_3	0.788	0.650	0.554
NaBr	0.965	0.916	0.890	$K_2C_2O_4$	0.866	0.771	0.675
NaI	0.995	0.992	0.985	K_2CrO_4	0.866	0.771	0.675
NaOH	0.876	0.789	0.716	CH_3COOK	0.866	0.765	0.685
LiCl	0.980	1.008	1.045	HCOOK	0.868	0.760	0.678
LiBr	1.001	1.040	1.090	KBO_2	0.814	0.677	0.560
LiI	1.030	1.094	1.190	K_2HPO_4	0.860	0.749	0.664
LiOH	0.863	0.808	0.768	Na_2S	0.887	0.795	0.726
KF	0.839	0.722	0.626	*$KClO_3$	0.927	...	...
KNO_3	0.923	0.862	0.804	*$KBrO_3$	0.940	...	...
KNO_2	0.920	0.855	0.798	*KIO_3	0.951	...	...

* These salt solutions are 0.25 normal

Konowalow (1898) expressed the results of determinations of the solubility of ammonia in aqueous silver nitrate by the equation $H = 56.58\ (m - 2n)$ in which H = partial pressure of NH_3 in mm. of Hg., m = molecular concentrations of NH_3 and n = molecular concentration of $AgNO_3$. Similar results are given in later papers (Konowalow, 1899, *a*, *b*) for a large number of other salt solutions.

Gaus (1900) gives data for the vapor pressure of ammonia in aqueous 0.4 n solutions of about 20 salts, only a few of which occur in the above table.

Solubility of Ammonia in Absolute Ethyl Alcohol.

(Delepine — J. pharm chim [5] 25, 496, 1892, de Bruyn — Rec trav chim 11, 112, '92)

t°.	Density.	Gms NH_3 per 100 cc Solution	Gms NH_3 per 100 Gms Solution. (Delepine)	(de Bruyn)	Gms NH_3 per 100 Gms Alcohol (Delepine)	(de Bruyn)
0	0.782	13 05	20 95	19 7	26 5	24 5
5	0.784	12 00	19 00	17 5	23 0	21 2
10	0.787	10 85	16 43	15 0	19 6	17 8
15	0 789	9 20	13 00	13 2	15 0	15 2
20	0 791	7 50	10 66	11 5	11 9	13 2
25	0 794	6 00	10 0	10 0	11 0	11 2
30	0 798	5 15	9 7	8 8	10 7	9 5

According to Muller (1891), one volume of alcohol absorbs 340 volumes of ammonia at 20° and 760 mm. pressure.

Solubility of Ammonia in Aqueous Ethyl Alcohol.

(Delepine)

t°.	In 96% Alcohol Sp Gr Solution.	G. NH_3 per 100 Gms Sol	In 90% Alcohol Sp Gr Solution.	G. NH_3 per 100 Gms Sol	In 80% Alcohol Sp Gr Solution.	G. NH_3 per 100 Gms. Sol.
0	0 783	24 5	0 800	30 25	0 808	39 0
10	0 803	18 6	0 794	28 8	0 800	28 8
20	0 788	14 8	0 795	15 8	0 821	19 1
30	0 791	10 7	0.796	11 4	0 826	12 2

t°.	In 60% Alcohol Sp Gr Solution	G NH_3 per 100 Gms Sol	In 50% Alcohol Sp Gr Solution.	G NH_3 per 100 Gms Sol.
0	0 830	50 45	0 835	69 77
10	0 831	37 3	0 850	43 86
20	0 842	26 1	0 869	33 8
30	0 846	21 2	0 883	25 2

Solubility of Ammonia in Absolute Methyl Alcohol.

(de Bruyn — Rec trav chim 11, 112, '92)

t°.	G NH_3 per 100 Grams Solution	Alcohol	t°	G NH_3 per 100 Grams Solution	Alcohol.
0	29 3	41 5	20	19 2	23 8
5	26 5	36 4	25	16 5	20 0
10	24 2	31 8	30	14 0	16.0
15	21.6	27.8			

Solubility of Ammonia in Ethyl Ether.

(Christoff, 1912)

Results in terms of the Ostwald Solubility Expression (see page 227), at 0° = 17.13, at 10° = 12.35, at 15° = 10 27.

Freezing-point lowering curves (Solubility, see footnote, page 1) are given by Baumé and Perrot (1910), (1914) for mixtures of ammonia and methyl alcohol and for mixtures of ammonia and methyl ether, results for ammonium and potassium, ammonium and sodium, and ammonium and lithium are given by Ruff and Geisel (1906); results for ammonium and hydrogen sulfide are given by Scheffer (1912).

Solubility of Ammonia in Hydroxylamine.

(de Bruyn, 1892)

100 gms. of the sat. solution contain 26 gms. NH_3 at ±0° and 19-20 gms. at 15°-16°.

DISTRIBUTION OF AMMONIA BETWEEN:

Water and Amyl Alcohol at 20°.

(Herz and Fischer — Ber 37, 4747, '04)

Gms NH_3 per 100 cc.		G M NH_3 per 100 cc.	
Aq Layer	Alcoholic Layer	Aq Layer	Alcoholic Layer
0 5	0 072	0 25	0 0035
1 0	0 147	0 50	0 0073
2 0	0 272	1 00	0 0148
3 0	0 438	2 00	0 0295
4 0	0 595	3.00	0.0460
5 0	0.756		

Water and Chloroform at 20°.

(Dawson and McCrae — J Ch Soc 79, 496, '01; see also Hantsch and Sebaldt — Z phys Ch 30, 258, '99.)

Gms NH_3 per 100 cc		G. M NH_3 per 100 cc.	
Aq Layer	$CHCl_3$ Layer.	Aq Layer.	$CHCl_3$ Layer.
0.2	0 007	0.01	0.00038
0.4	0 015	0 02	0.00073
0.6	0 023	0.03	0 00114
0 8	0 031	0 04	0 00152
1 0	0 039	0 05	0 00193
1 2	0 046	0 06	0.00232
1 4	0 055	0 08	0.00311
1.6	0 063	0 10	0 00396

For calculations of above distribution results see Note, page 6.

Additional data for the distribution of ammonia between water and chloroform are given by Dawson and McCrae (1900), (1901*a*), (1901*b*); Dawson (1906), (1909); Abbott and Bray (1907); Sherrill and Russ (1907), Bell (1911), and by Moore and Winmill (1912). The results show that with increase of concentration of ammonia, the relative amount in the aqueous layer diminishes. Thus Bell found that at 25° the distribution ratio is 22.7 when the aqueous layer contains 1 02 gm. mols. NH_3 per liter and only 10 when 12 23 gm. mols. NH_3 are present in the aqueous layer. The influence of increase of temperature was also found to be in the direction of diminution of the relative amount in the aqueous layer

The influence of the presence of a large number of salts in the aqueous layer has been studied by several of the above-mentioned investigators. In the case of copper, zinc and cadmium salts (Dawson and McCrae, 1900), (Dawson, 1909), the distribution ratio varied with salt concentration in a manner indicating that metal ammonia compounds were formed.

Results for the effect of KOH, NaOH and $Ba(OH)_2$ on the distribution at 18° are given by Dawson (1909).

Results for the effect of ammonium chromate upon the distribution at 25° are given by Sherrill and Russ (1907).

Results for the distribution of ammonia between water and mixtures of chloroform and amyl alcohol at 25° are given by Herz and Kurzer (1910).

DISTRIBUTION OF AMMONIA BETWEEN TOLUENE AND AIR.

(Hantzsch and Vagt, 1901)

t°.	Gms NH_3 per 1000 cc		Mols NH_3 per 1000 cc	
	$C_6H_5CH_3$ Layer	Air	$C_6H_5CH_3$ Layer.	Air.
0	0.366	0.0396	0 0215	0 00233
10	0.357	0.0435	0.0210	0.00256
20	0.326	0.0451	0.0192	0.00265
30	0.286	0.0462	0.0168	0.00272

AMMONIUM ACETATE CH_3COONH_4.

100 cc. of sat. solution in acetone contain 0.27 gm. CH_3COONH_4 at 19°.

(Roshdestwensky and Lewis, 1912.)

AMMONIUM ARSENATES.

THE SYSTEM AMMONIA, ARSENIC TRIOXIDE AND WATER AT 30°.

(Schreinemakers and de Baat, 1915.)

Gms. per 100 Gms. Sat. Sol. NH_3	Gms. per 100 Gms. Sat. Sol. As_2O_3	Solid Phase	Gms. per 100 Gms. Sat. Sol. NH_3	Gms. per 100 Gms. Sat. Sol. As_2O_3	Solid Phase
0	2.26	As_2O_3	3.13	12.30	NH_4AsO_2
1.41	10.98	"	3.91	7.63	"
2.78	20.49	"	6.95	4.72	"
2.86	21.17	"	9.93	3.20	"
2.88	18.43	NH_4AsO_2	4.28	2.16	"

Data are also given for the system $NH_4Cl + As_2O_3 + H_2O$ at 30°.

100 gms. H_2O dissolve 0.02 gm. $NH_4CaAsO_4.\frac{1}{2}H_2O$. (Field, 1873.)

" " " " 0.014 " $NH_4MgAsO_4.\frac{1}{2}H_2O$. "

SOLUBILITY OF AMMONIUM MAGNESIUM ARSENATE IN WATER AND IN AQUEOUS SOLUTIONS OF AMMONIUM SALTS.

(Wenger, 1911.)

t°.	Gms. NH_4MgAsO_4 per 100 Gms. of Each Solvent: Water	Aq. 5% NH_4NO_3	Aq. 5% NH_4Cl	Aq.* NH_4OH	Aq. NH_4OH† + 5% NH_4Cl	Aq. NH_4OH† + 10% NH_4Cl	Solid Phase.
0	0.0339	0.092	0.084	0.0087	...	...	$NH_4MgAsO_4.6H_2O$
20	0.0207	0.114	0.113	0.0096	0.013	0.032	"
30	...	0.118	0.113	...	...	...	"
40	0.0275	0.139	0.190	0.0117	...	...	"
50	0.0226	0.189	0.189	0.0100	...	...	"
60	0.0210	0.211	0.219	0.0090	0.047	0.054	"
70	0.0156	0.189	0.221	0.0095	...	...	"
80	0.0236	0.189	0.231	0.0091	...	...	"

* Composed of 1 part $NH_4OH(d = 0.96)$ + 3 parts H_2O.
† Contained 4 parts $NH_4OH(d = 0.96)$ per 100 parts NH_4Cl solution.

AMMONIUM BENZOATE $C_6H_5COONH_4$.

SOLUBILITY IN WATER AND IN AQUEOUS ALCOHOL AT 25°.

(Seidell, 1910.)

Gms. C_2H_5OH per 100 Gms. Solvent.	d_{25} of Sat. Sol.	Gms. $C_6H_5COONH_4$ per 100 Gms. Sat. Sol.	Gms. C_2H_5OH per 100 Gms. Solvent.	d_{25} of Sat. Sol.	Gms. $C_6H_5COONH_4$ per 100 Gms. Sat. Sol.
0	1.043	18.6	60	0.939	15
10	1.027	18	70	0.901	12.2
20	1.012	18	80	0.864	8.3
30	0.997	18.1	90	0.828	4.2
40	0.979	18	95	0.810	2.7
50	0.956	17	100	0.796	1.6

100 gms. water dissolve 19.6 gms. $C_6H_5COONH_4$ at 14°.5, d_{14} of sat. sol. = 1.042. (Greenish and Smith, 1901.)

100 gms. water dissolve 83.33 gms. $C_6H_5COONH_4$ at b.-pt. (U. S. P.)

100 gms. glycerol dissolve 10 gms. $C_6H_5COONH_4$ at room temp. (Hager.)

THE SYSTEM AMMONIA, BORIC ACID AND WATER AT 30° AND AT 60°.
(Sborgi, 1913-15, Sborgi and Meccacci, 1916)

Results at 30°. Gms per 100 Gms Sat Sol. $(NH_4)_2O$	B_2O_3	Solid Phase	Results at 60°. Gms per 100 Gms Sat Sol. $(NH_4)_2O$	B_2O_3	Solid Phase.
0.23	4.81	H_3BO_3	0	7.39	H_3BO_3
0.70	7.20	"	0.78	12.12	"
0.78	7.62	H_3BO_3+1.5.8	1.42	15.60	H_3BO_3+1.5.8
0.99	7.53	1.5.8	1.70	15.29	1.5.8
1.08	7.66	"	3.23	18.60	"
1.71	9.13	"	4.02	20.38	1.5.8+1.4.6
2.25	10.71	"	4.88	21.76	1.4.6
2.89	12.32	"	6.41	24.32	"
3.13	12.59	"	7.90	27.31	1.4.6+1.2.4
3.43	6.35	2.4.5	7.83	26.76	1.2.4
6.51	4.48	"	7.91	17.57	"
10.45	3.37	"	9.57	13.56	"
18.05	2.02	"	15.45	8.33	"
24.80	1.51	"	19.47	5.92	"
30.56	1.22	"	22.57	4.47	"
45.34	0.84	"			

1.5.8 = $(NH_4)_2O\ 5B_2O_3\ 8H_2O$ 1.4.6 = $(NH_4)_2O\ 4B_2O_3\ 6H_2O$
2.4.5 = $2(NH_4)_2O\ 4B_2O_3.5HO_2$ 1.2.4 = $(NH_4)_2O\ 2B_2O_3.4H_2O$

AMMONIUM BROMIDE NH_4Br.

SOLUBILITY IN WATER.
(Smith and Eastlack, 1916)

(Determinations by sealed tube method.)

t°.	Gms NH_4Br per 100 Gms H_2O	t°.	Gms NH_4Br per 100 Gms H_2O	t°.	Gms NH_4Br per 100 Gms H_2O
−17 Eutec.	47.3	60	107.8	130	180
0	60.6	70	116.8	137.3	Transition pt.
10	68	80	126	140	192.3
20	75.5	90	135.6	150	202.5
30	83.2	100	145.6	160	213.4
40	91.1	110	156.5	170	225.5
50	99.2	120	167.8		

SOLUBILITY OF AMMONIUM BROMIDE IN ABSOLUTE ETHYL ALCOHOL, METHYL ALCOHOL, AND IN ETHER.
(Eder, de Bruyn — Z phys Ch. 10, 783, '92)

t°.	In Ethyl Alcohol. Gms NH_4Br per 100 Grams. Solution	Alcohol.	In Methyl Alcohol. Gms NH_4Br per 100 Grams. Solution	Alcohol.	In Ether (0.720 Sp. Gr.). Gms NH_4Br per 100 Grams Ether
15	2.97	3.06	....	....	0.123
19	3.12	3.22	11.1	12.5	....
78	9.50	10.50	....	....	...

100 cc. ethyl alcohol of d_{15} = 0.8352 dissolve 7.8 grams NH_4Br at 15°, d_{15} of sat. sol. = 0.8848. (Greenish, 1900)

100 cc. anhydrous hydrazine dissolve 110 gms. NH_4Br at room temp. with evolution of ammonia. (Welsh and Broderson, 1915.)

SOLUBILITY OF AMMONIUM BROMIDE AT 25° IN MIXTURES OF

(Herz and Kuhn, 1908.)

Methyl and Ethyl Alcohols.			Propyl and Methyl Alcohols			Propyl and Ethyl Alcohols		
Gms CH_3OH per 100 Gms Solvent	$d\frac{25}{4}$ of Sat Sol	Gms NH_4Br per 100 cc Sat Sol	Gms C_3H_7OH per 100 Gms Solvent	$d\frac{25}{4}$ of Sat Sol	Gms NH_4Br per 100 cc Sat Sol	Gms C_3H_7OH per 100 Gms Solvent	$d\frac{25}{4}$ of Sat Sol	Gms NH_4Br per 100 cc Sat Sol
0	0.8065	2.55	0	0.8605	9.83	0	0.8065	2.55
4.37	0.8083	2.99	11.11	0.8524	8.51	8.51	0.8062	2.51
10.40	0.8117	3.21	23.8	0.8426	6.90	17.85	0.8052	2.37
41.02	0.8252	5.06	65.2	0.8184	3.08	56.6	0.8048	1.64
80.69	0.8501	8.13	91.8	0.8097	1.28	88.6	0.8042	1.11
84.77	0.8508	8.47	93.75	0.8089	1.25	91.2	0.8049	1.05
91.25	0.8551	9.34	100	0.8059	0.95	95.2	0.8059	1.04
100	0.8605	9.83				100	0.8059	0.95

AMMONIUM Cadmium **BROMIDE** $(NH_4)CdBr_3.\frac{1}{2}H_2O$.

100 parts water dissolve 137 parts of the salt, 100 parts of alcohol dissolve 18.8 parts and 100 parts of ether dissolve 0.36 part. (Eder, 1876.)

AMMONIUM Platinum **BROMIDE** $(NH_4)_2PtBr_6$.

100 gms. sat aqueous solution contain 0.59 gm. salt at 20°. (Halberstadt, 1884.)

SOLUBILITY OF TETRA ETHYL **AMMONIUM BROMIDE** $N(C_2H_5)_4Br$, AND OF TETRA METHYL AMMONIUM BROMIDE $N(CH_3)_4Br$ IN ACETONITRILE.

(Walden — Z. phys. Ch., 55, 712, '06.)

100 cc. sat. solution in CH_3CN contain 9.59 gms. $N(C_2H_5)_4Br$ at 25°.
100 cc. sat. solution in CH_3CN contain 0.17 gm. $N(CH_3)_4Br$ at 25°.

SOLUBILITY OF TETRA ETHYL AMMONIUM BROMIDE IN WATER AND IN CHLOROFORM AT 25°.

(Peddle and Turner, 1913.)

100 gms. H_2O dissolve 279.5 gms. $N(C_2H_5)_4Br$.
100 gms. $CHCl_3$ dissolve 25.01 gms. $N(C_2H_5)_4Br$.

Data for the distribution of propyl benzyl methyl phenyl **AMMONIUM BROMIDE** between water and chloroform at 25° are given by Wedekind and Paschke (1910).

AMMONIUM CARBONATE $(NH_4)_2CO_3$.

100 gms. H_2O dissolve 25.4 gms. ammonium carbonate, calculated as $C_2H_{11}N_3O_5$ at 16.7° *d* of sat. sol. = 1.095. (Greenish and Smith, 1901.)

100 gms. of carefully purified glycerol dissolve 20 gms. $(NH_4)_2CO_3$ at 15°. (Ossendowski, 1907.)

AMMONIUM BICARBONATE NH_4HCO_3.

SOLUBILITY IN WATER.

(Dibbits — J. pr. Ch. [2] 10, 417, '74.)

t°.	Gms. NH_4HCO_3 per 100 Grams. Solution.	Water.	t°.	Grams NH_4HCO_3 per 100 Grams. Solution	Water
0	10.6	11.9	20	17.4	21.0
5	12.1	13.7	25	19.3	23.9
10	13.7	15.8	30	21.3	27.0
15	15.5	18.3			

SOLUBILITY OF AMMONIUM BICARBONATE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE SATURATED WITH CO_2.

(Fedotieff — Z. phys. Ch. 49, 168, '04)

t°.	Wt. of 1 cc. Sol.	Per 1000 cc Solution. G. M. NH_4Cl.	G. M NH_4HCO_3.	Gms NH_4Cl.	Gms. NH_4HCO_3.	Per 1000 Grams H_2O. G. M. NH_4Cl.	G. M NH_4HCO_3.	Gms. NH_4Cl.	Gms. NH_4HCO_3.
0	...	...	...	...	...	0.0	1.22	0.0	119.0
0	1.077	4.41	0.37	235.9	29.2	5.42	0 46	290.8	36.0
15	1.064	0.0	2.12	0.0	167.2	0.0	2.36	0.0	186.4
15	1.063	0.5	1.84	26.8	145 2	0.56	2 06	29.9	162.9
15	1.062	1 0	1.59	53.5	125.5	1.13	1.80	60.6	142.2
15	1.062	1.41	1.42	75.4	112.2	1 59	1.60	85.1	126.9
15	1.065	1.89	4 28	100.8	101 1	2 18	1.48	116 8	116.8
15	1.069	2.87	0 99	153.3	78.2	3.42	1 18	183 0	93.3
15	1.076	3.84	0 79	205 2	62 5	5 03	0 98	269.3	77.3
15	1 085	4 82	0.65	257 9	51 4	6 21	0.84	332.5	66.4
15	1.085	4.95	0.62	264.8	48 9	6 40	0.81	343.5	64.2
30	...	...	...	...	...	0 0	3.42	0 0	270.0
30	...	...	...	...	...	7.4	1.15	397 0	91.0

SOLUBILITY OF AMMONIUM BICARBONATE IN AQUEOUS SOLUTIONS OF SODIUM BICARBONATE SATURATED WITH CO_2.

(Fedotieff.)

t°.	Wt. of 1 cc. Sol.	Per 1000 cc Solution. G. M $NaHCO_3$.	G. M. NH_4HCO_3.	Gms $NaHCO_3$.	Gms NH_4HCO_3.	Per 1000 Grams H_2O. G M $NaHCO_3$.	G. M NH_4HCO_3.	Gms. $NaHCO_3$.	Gms. NH_4HCO_3
0	...	...	...	...	...	0 0	1.51	0.0	119.0
0	1.072	0.53	1.28	44.6	101.4	0.58	1.39	48.2	109 4
15	1.064	0.0	2.12	0.0	167.2	0.0	2.36	0.0	186.4
15	1.090	0.63	1.92	52.5	151.3	0.71	2.16	59.2	170.6
30	...	...	...	...	...	0.0	3.42	0.0	270.0
30	...	...	...	...	...	0.83	2.91	70.0	230.0

SOLUBILITY OF AMMONIUM BICARBONATE IN AQUEOUS SOLUTIONS OF AMMONIUM NITRATE.

(Fedotieff and Koltunoff, 1914.)

t°.	d of Sat. Sol.	Gms per 100 Gms H_2O. NH_4NO_3.	NH_4HCO_3.	t°.	d of Sat. Sol.	Gms per 100 Gms H_2O. NH_4NO_3.	NH_4HCO_3.
0		0	11.90	15	1.242	103.4	8.25
0	1.265	118	4.52	15	1.269	128.9	7.79
15	1.064	0	18.64	15	1.302	166.9	7.46
15	1.113	23.26	12.91	30	...	0	26 96
15	1.164	49.82	10.33	30	...	231.9	12.57

SOLUBILITY OF MIXTURES OF AMMONIUM BICARBONATE, SODIUM BICARBONATE, AND AMMONIUM CHLORIDE IN WATER SATURATED WITH CO_2.

(Fedotieff.)

t°.	Wt. of 1 cc Sol.	Gram Mols. per 1000 Gms. H_2O.			Gms. per 1000 Gms. H_2O.			Solid Phase.
		$NaHCO_3$.	NaCl.	NH_4Cl.	$NaHCO_3$.	NaCl.	NH_4Cl.	
0	1.114	0.59	0.96	4.92	49.61	56.16	263.4	a + b + c
0	1.187	0.12	4.83	2.74	10.09	282.6	146.7	"
15	1.116	0.93	0.51	6.28	78.18	29.84	336.2	"
15	1.178	0.18	4.44	3.73	15.13	259.8	199.6	"
15	1.151	0.30	3.09	4.56	25.22	180.8	244.1	a + c
15	1.128	0.51	1.68	5.45	42.87	98.28	291.7	"
15	1.112	0.99	0.35	5.65	83.22	20.47	302.4	a + b
15	1.108	1.07	0.20	5.21	89.95	11.70	278.9	"
15	1.106	1.12	0.11	4.92	94.14	6.44	263.4	"
15	1.101	1.16	0.14	4.00	97.52	8.19	214.1	"
15	1.090	0.93	0.95	2.03	78.18	55.58	108.6	"

a = $NaHCO_3$, b = NH_4HCO_3, c = NH_4Cl.

AMMONIUM Uranyl **CARBONATE** $2(NH_4)_2CO_3.UO_2CO_3$.

(Ebelmen.)

100 grams H_2O dissolve 5 grams of the salt at 15°.

AMMONIUM Lead **COBALTICYANIDE** $NH_4PbCo(CN)_6.3H_2O$.

(Schuler — Sitz. Ber. K. Akad. W. (Berlin) 79, 302.)

100 grams H_2O dissolve 12 grams of the salt at 18°.

AMMONIUM Per**CHLORATE** NH_4ClO_4.

SOLUBILITY IN WATER.

(Carlton, 1910.)

t°.	Sp. Gr. Sat. Sol.	Gms. NH_4ClO_4 per 100 cc. Sat. Sol.	t°.	Sp. Gr. Sat. Sol.	Gms. NH_4ClO_4 per 100 cc. Sat. Sol.
0	1.059	11.56	80	1.193	48.19
20	1.098	20.85	100	1.216	57.01
40	1.128	30.58	107 b. pt.	1.221	59.12
60	1.158	39.05			

In a paper by Thin and Cumming (1915), it is stated that ammonium perchlorate is "sparingly soluble" in water and according to one determination at 14.2°, 100 gms. of the sat. solution was found to contain 1.735 gms. NH_4ClO_4. It is probable that these authors have misplaced the decimal point. This appears more probable since a determination of the solubility in 98.8 per cent ethyl alcohol at 25.2° gave 1.96 gms. NH_4ClO_4 per 100 gms. sat. solution, and in 98.8 per cent alcohol containing 0.2 per cent $HClO_4$ gave 1.97 gms. per 100 gms. sat. solution.

SOLUBILITY OF AMMONIUM PERCHLORATE AND SEVERAL OF ITS DERIVATIVES IN WATER AT 15°. (Hofmann, Hobald and Quoos (1911-12))

	Gms Salt per 100 Gms H_2O		Gms Salt per 100 Gms H_2O
NH_4ClO_4	18.5	$CH_3(C_2H_5)_3NClO_4$	23.6
$CH_3NH_3ClO_4$	109.6	$C_3H_7(C_2H_5)_3NClO_4$	7.9
$(CH_3)_2NH_2ClO_4$	208.7	$(CH_3)_2(C_2H_5)_2NClO_4$	134.3
$C_2H_5NH_3ClO_4$	208.7	$C_2H_3(CH_3)_3NClO_4$	5
$(C_2H_5)_2NH_2ClO_4$	150.9	$BrC_2H_4(CH_3)_3NClO_4$	3.5
$(CH_3)_3NHClO_4$	19.9	$BrC_2H_2(CH_3)_2NClO_4$	2.5
$(CH_3)_4NClO_4$	0.5	$(OH)C_2H_4(CH_3)_3NClO_4$	290.7
$(C_2H_5)_4NClO_4$	3.7	$(OH)CH_2CH(OH)CH_2(CH_3)_3NClO_4$	155.7
$C_6H_5(CH_3)_3NClO_4$	17.9	$NO_3C_2H_4(CH_3)_3NClO_4$	0.6
$ICH_2(CH_3)_3NClO_4$	3.1	$C_3H_5(CH_3)_3NClO_4$	199.5
$C_2H_5(CH_3)_3NClO_4$	10.9	$C_2H_4(NH_3ClO_4)_2$	144.5
$C_3H_7(CH_3)_3NClO_4$	15.4	$C_2H_4[(CH_3)_3NClO_4]_2$	1.2
$C_4H_9(CH_3)_3NClO_4$	3.7	$C_3H_6[(CH_3)_3NClO_4]_2$	1.5
$C_5H_{11}(CH_3)_3NClO_4$	2.2	$Br_2C_3H_5(CH_3)_3NClO_4$	2.2
		$BrC_3H_6(CH_3)_3NClO_4$	2.6

Milbauer (1912-13) found that 100 gms. of cold H_2O dissolve 1.126 gm. tetramethyl ammonium perchlorate $(CH_3)_4NClO_4$ and 100 gms. alcohol dissolve 0.04 gm. of the salt.

AMMONIUM CHLORIDE NH_4Cl.

SOLUBILITY IN WATER.

(Mulder, below 0°, Meerburg — Z. anorg. Ch. 37, 203, 1903.)

t°.	Gms. NH_4Cl per 100 Gms. Solution	Gms. NH_4Cl per 100 Gms. Water	t°.	Gms. NH_4Cl per 100 Gms. Solution	Gms. NH_4Cl per 100 Gms. Water
−15	19.7	24.5	40	31.4	45.8
−10.9	20.3	25.5	50	33.5	50.4
−5.7	21.7	27.7	60	35.6	55.2
0	22.7	29.4	70	37.6	60.2
+5	23.8	31.2	80	39.6	65.6
10	24.9	33.3	90	41.6	71.3
15	26.0	35.2	100	43.6	77.3
20	27.1	37.2	110	45.6	83.8
25	28.2	39.3	115.6	46.6	87.3
30	29.3	41.4			

Density of saturated solution at 0° = 1.088, at 15° = 1.077, at 19° = 1.075.

Eutectic, Ice + NH_4Cl = −16° and 19.5 gms. NH_4Cl per 100 gms. sat. sol.

100 gms. H_2O dissolve 31.25 gms. NH_4Cl at 3.5°, 38.5 gms. at 25° and 49.6 gms. at 50°. (Biltz and Marcus, 1911.)

Data for the solubility of ammonium chloride in water at 0° under pressures up to 500 atmospheres are given by Stackelberg, 1896.

SOLUBILITY OF AMMONIUM CHLORIDE IN AQUEOUS AMMONIUM BICARBONATE SOLUTIONS SATURATED WITH CO_2. (Fedotieff — Z. Phys. Ch. 49, 169, 1904.)

t°.	Wt. of 1 cc. Sol.	Per 1000 cc. Solution. G. M. NH_4HCO_3	G. M. NH_4Cl.	Gms. NH_4HCO_3.	Gms. NH_4Cl	Per 1000 Gms. H_2O. G. M. NH_4HCO_3.	G. M. NH_4Cl	Gms. NH_4HCl.	Gms. NH_4Cl.
0	1.069	0.0	4.60	0.0	246.1	0.0	5.57	0.0	298.0
0	1.077	0.37	4.41	29.2	235.9	0.46	5.42	36.0	290.8
15	1.077	0.0	5.29	0.0	283.1	0.0	6.64	0.0	355.9
15	1.085	0.62	4.95	48.9	264.8	0.81	6.40	64.2	343.5
30	...	...	...	...	..	0.0	7.78	0.0	416.4
30	...	...	...	...	...	1.15	7.40	91.0	397.9

Solubility in Aqueous Ammonia Solutions at 0°.

(Engel — Bull. soc chim [3] 6, 17, 1891.)

Sp Gr. of Solutions.	Milligram Molecules per 10 cc. Solution		Grams per 100 cc. Solution.	
	NH_3.	NH_4Cl	NH_4OH	NH_4Cl.
1.067	5 37	45 8	0 92	24 52
1 054	12 02	45 5	2 05	24 35
1 031	38 0	44 5	6 48	23 82
1 025	47 0	44 0	8 02	23 56
1 017	54 5	43 63	9 30	23 35
0 993	80 0	43 12	13 66	23 09
0 992	90 0	44 0	15 36	23 56
0 983	95 5	44 37	16 29	23 75
0 953	130 0	49 75	22.18	26.63
0 931	169 75	60 0	28.97	32.14

Solubility of NH_4Cl in Aqueous Ammonia Solutions at 17.5°.

(Stromholm, 1908.)

Normality Equiv per Liter.		Gms per 1000 cc Solution	
NH_3	NH_4Cl	NH_3	NH_4Cl
0	5 435	0	290.8
0 15	5 420	2.55	290
4.76	5 082	81	271.9

olubilities of Mixtures of Ammonium Chloride and Other Salts in Water.

(Rudorff, Karsten, Mulder.)

Both salts present in solid phase.

°.	Grams per 100 Grams H_2O		t°	Grams per 100 Grams H_2O	
) 5	29 2 NH_4Cl + 174 0 NH_4NO_3	R	b pt	67 7 NH_4Cl + 21 9 KCl	M
.5	26 8 " + 46 5 $(NH_4)_2SO_4$	R	14 8	38 8 " + 34 2 KNO_3	K
).0	33 8 " + 11 6 $BaCl_2$	R	18 5	39 8 " + 38 6 KNO_3	K
5	39 2 " + 17 0 $Ba(NO_3)_2$	K	14 0	36 8 " + 14 1 K_2SO_4	R
0	28 9 " + 16 9 KCl	R	18 7	37 9 " + 13 3 K_2SO_4	K
0	30.4 " + 19 1 KCl	R	18.7	22.9 " + 23 9 NaCl	R

olubility of Ammonium Chloride in Aqueous Solutions of Ammonium Sulfate at 30°.

(Wibaut, 1909, Schreinemakers, 1910.)

ns per 100 Gms Sat Sol		Solid Phase.	Gms per 100 Gms Sat Sol		Solid Phase
$(NH_4)_2SO_4$	NH_4Cl		$(NH_4)_2SO_4$	NH_4Cl	
0	29 5	NH_4Cl	25	18 3	$NH_4Cl + (NH_4)_2SO_4$
5	28 5	"	30	13 2	$(NH_4)_2SO_4$
10	25 7	"	35	8.5	"
15	23.2	"	40	2.8	"
20	20 2	"	42	0	"

olubility of Mixtures of Ammonium Chloride and Cobalt Chloride in Water at 25°.

(Foote, 1912.)

ns per 100 Gms Sat Sol.		Gms per 100 Gms Solid Residue			Solid Phase.
NH_4Cl	$CoCl_2$	NH_4Cl.	$CoCl_2$	H_2O.	
17.90	15.63	...	3 2	...	Mixed crystals of $NH_4Cl + CoCl_2.2H_2O$
13.59	25.19	83 01	13 52	3.47	"
6.75	34 28	35 12	50 66	14 22	"
7.45	35.24	34 02	40.64	16 31	Mixed crystals + $CoCl_2.6H_2O$
7.62	34.61	7.07	55.27	37.66	"

Solubility of Ammonium Chloride in Aqueous Hydrochloric Acid.

Results at 0°. (Engel, 1888.)

Sp. Gr. of Sat. Sol.	Gms. per 100 cc. sat. sol. HCl	Gms. per 100 cc. sat. sol. NH_4Cl
1.076	0	24.61
1.069	1.05	23.16
1.070	1.99	21.78
1.073	3.93	19.36
1.078	7.74	14.54
1.106	19.18	5.78
1.114	22.07	4.67

Results at 25°. (Armstrong and Eyre, 1910–11.)

Gms. HCl per 100 Gms. H_2O.	d ?? Sat. Sol.	Gms. NH_4Cl per 100 Gms. Sat. Sol.
0	1.080	28.3
0.91	1.079	27.4
1.82	1.082	26.4
3.65	1.083	24.6
18.25	1.099	11.3

Solubility of Mixture of Ammonium Chloride and Lead Chloride in Water at Several Temperatures.

(At 17°, 50° and 100° Demassieux (1913) at 25° Foote and Levy, 1907.)

At 17°. Gms. per 100 Gms. Sol. $PbCl_2$	NH_4Cl	At 25°. Gms. per 100 Gms. Sol. $PbCl_2$	NH_4Cl	At 50°. Gms. per 100 Gms. Sol. $PbCl_2$	NH_4Cl	At 100°. Gms. per 100 Gms. Sol. $PbCl_2$	NH_4Cl	Solid Phase in Each Case.
0.30	27.03	...	...	0.32	34.14	1.61	43.42	NH_4Cl
0.52	26.68	...	...	2.65	33.62	4.21	42.91	"
0.64	26.49	1.20	28.15	3.96	33.56	..	..	" +1.2
...	...	...	...	...	...	9.26	41.90	" +2.1
...	...	...	...	...	...	9.88	40.22	2.1
...	...	...	...	...	...	11.60	38.32	"
...	...	...	...	...	...	12.67	37.62	" +1.2
0.34	22.32	0.93	27.45	3.31	31.90	11.40	36.29	1.2
0.098	12.36	0.35	21.59	1.76	27.16	8.32	32.64	"
0.078	4.93	0.29	17.97	0.71	19.42	4.54	26.08	"
0.078	4.23	0.11	10.25	0.49	12.45	1.98	13.12	"
0.076	3.48	0.03	2.77	0.48	4.86	1.76	8.59	" $+PbCl_2$
0.16	1.43	...	...	0.67	1.45	1.85	5.33	$PbCl_2$
0.21	0.96	...	...	1.08	0.51	2.02	1.32	"
0.89	0	...	...	1.69	0	3.10	0	"

1.2 = $NH_4Cl.2(PbCl_2)$, 2.1 = $2NH_4Cl\,PbCl_2$.

The following additional data for the above system at 22° are given by Brönsted (1909).

Gm. Equiv. NH_4Cl per 100 Gms. H_2O	Gm. Equiv. $PbCl_2$ per 100 Gms. Sat. Sol.	Solid Phase.	Gm. Equiv. NH_4Cl per 100 Gms. H_2O.	Gm. Equiv. $PbCl_2$ per 100 Gms. Sat. Sol.	Solid Phase.
0	7.49×10^{-3}	$PbCl_2$	0.8	0.837×10^{-3}	$2PbCl_2.NH_4Cl$
0.1	3.10×10^{-3}	"	1	0.758×10^{-3}	"
0.2	1.916×10^{-3}	"	2	0.695×10^{-3}	"
0.4	1.348×10^{-3}	"	3	0.968×10^{-3}	"
0.5	1.263×10^{-3}	"	4	1.502×10^{-3}	"
0.55	1.189×10^{-3}	$2PbCl_2.NH_4Cl$	5	2.338×10^{-3}	"
[0.6	1.092×10^{-3}	"	6	3.580×10^{-3}	"
0.7	0.956×10^{-3}	"	7.29 sat.	6.46×10^{-3}	" $+NH_4Cl$

The two curves intersect at 0.52 normal NH_4Cl.

Solubility of Mixtures of Ammonium Chloride and Magnesium Chloride in Water. (Biltz and Marcus, 1911.)

t°	Gms. per 100 Gms. Sat. Sol. $MgCl_2$	NH_4Cl	Solid Phase.	t°	Gms. per 100 Gms. Sat. Sol. $MgCl_2$	NH_4Cl	Solid Phase.
3.5	21.41	5.93	$NH_4Cl+MgCl_2.6H_2O$	3.5	34.43	0.09	$(NH_4)MgCl_3.6H_2O + MgCl_2.6H_2O$
25	20.95	8.78	"	25	35.41	0.09	" "
50	20.84	12.46	"	50	36.92	0.15	" "

SOLUBILITY OF MIXTURES OF AMMONIUM AND MANGANESE CHLORIDES IN WATER AT 25°.

(Foote and Saxton, 1914)

Gms per 100 Gms Sat Sol. NH_4Cl	$MnCl_2$	Solid Phase	Gms per 100 Gms Sat Sol. NH_4Cl	$MnCl_2$	Solid Phase
23.97	7.97	α mixed crystals	17.09	18.76	β mixed crystals or double salt $2NH_4Cl.MnCl_2.2H_2O$
22.94	9.65	"	15.05	22.44	"
21.44	12.31	"	13.17	24.52	"
21.18	13.38	"	9.15	29.24	"
20.10	15.19	"	5.90	34.78	"
19.70	15.92	α and β mixed crystals	3.77	39.48	"
19.75	16.02	"	2.98	43.71	$2NH_4Cl.MnCl_2.2H_2O + MnCl_2.2H_2O$
19.67	15.47	"	2.94	43.44	"

α mixed crystals consist of NH_4Cl with varying amounts of $MnCl_2.2H_2O$, β mixed crystals consist of the double salt $2NH_4Cl.MnCl_2.2H_2O$ with excess of NH_4Cl.

This case represents a very rare type of solid solution "in which a single salt and a double salt are each capable of taking up very considerable quantities of the other to form homogeneous mixed crystals."

EQUILIBRIUM IN THE SYSTEM AMMONIUM CHLORIDE, MERCURIC CHLORIDE, WATER AT 30°.

(Meerburg, 1908)

Gms per 100 Gms Sat Sol. $HgCl_2$	NH_4Cl	Solid Phase	Gms per 100 Gms Sat Sol. $HgCl_2$	NH_4Cl	Solid Phase
0	29.50	NH_4Cl	57.05	9.92	3.2.1
22.80	26.91	"	58.65	9.20	" + 9.2
42.45	25.05	"	*51.83	8.76	9.2
50.05	24.79	" + 1.2.1	*46	7.52	"
53.08	22.77	1.2.1	*35.60	5.26	"
58.90	20.02	" + 1.1.1	*32.90	5.06	"
56.38	18.50	1.1.1	29.65	3.62	" + $HgCl_2$
55.58	16.82	"	40.12	5.13	$HgCl_2$
57.01	14.12	" + 3.2.1	21	2.29	"
56.26	13.04	3.2.1	7.67	0	"

1.2.1 = $HgCl_2.2NH_4Cl.H_2O$, 1.1.1 = $HgCl_2.NH_4Cl.H_2O$;
3.2.1 = $3HgCl_2.2NH_4Cl.H_2O$, 9.2 = $9HgCl_2.2NH_4Cl$.

* In these solutions 2 to 3 weeks were required for attainment of equilibrium

SOLUBILITY OF MIXTURES OF AMMONIUM AND NICKEL CHLORIDES IN WATER AT 25°.

(Foote, 1912)

Gms per 100 Gms Sat Sol. NH_4Cl	$NiCl_2$	Solid Phase.	Gms per 100 Gms Sat Sol. NH_4Cl	$NiCl_2$	Solid Phase
26.07	3.10	Mixed crystals of NH_4Cl and $NiCl_2.2H_2O$	7.98	37.41	Mixed crystals and $NiCl_2.6H_2O$
22.27	8.04	"	8.07	37.73	"
20.68	10.32	"	8.23	37.45	"
17.43	15.01	"	8.17	37.64	"
11.22	26.93	"	7.51	37.19	$NiCl_2.6H_2O$
10.21	30.56	"	3.06	37.98	"
9.16	35.70	"	0	37.53	"

SOLUBILITY OF MIXTURES OF POTASSIUM CHLORIDE AND AMMONIUM CHLORIDE IN WATER AT 25°.

(Fock — Z. Kryst. Min. 28, 353, '97.)

Grams per Liter Solution		Mol per cent in Solution		Sp Gr of Solutions.	Mol per cent in Solid Phase	
NH_4Cl	KCl.	NH_4Cl	KCl		NH_4Cl	KCl.
0 00	311 3	0 00	100 0	1.1807	0 0	100
22.81	293 3	9 41	90 59	1.1716	1.21	98.79
35.39	278.7	15 04	84.96	1.1678	2 11	97.89
89 17	273 2	34 26	65 74	1.1591	6 18	93.82
127 8	234 6	46 59	53 44	1.1493	8 90	91 10
147.2	204 2	51 63	48.37	1.1461	10 53	89 47
197.3	157.7	63 56	36.44	1.1391	17.86	82 14
232.5	116.8	73.49	26.51	1.1326	60.20	39.80
244 5	123.0	73 48	26.52	1.1329	76 88	23.12
261 9	111.0	79.10	20.90	1.1245	97 51	2.49
259.0	102.2	82.14	17.86	1.1212	97.79	2.21
278.6	53.16	87.96	12.04	1.1009	98.85	1.15
320.7	31.24	93.45	6.55	1.0912	99.33	0.67
273.5	0.00	100.00	0.00	1.0768	100.0	0.00

The following additional data for the above system are given by Biltz and Marcus (1911). The results show that $NH_4Cl + KCl$ form a series of mix-crystals broken by a gap which extends between about 20 and 98 mol. per cent NH_4Cl in the crystals.

Composition of Sat. Solution.				Composition of Solid Phase.		
Gms per 100 Gms Sat Sol		Mols per 1000 Mols H_2O		Gms per 100 Gms Crystals		Mol % NH_4Cl in Crystals.
NH_4Cl	KCl	NH_4Cl	KCl	NH_4Cl	KCl	
5.13	22 29	23 8	74.2	1 21	98.79	1 7
7	20 40	32 5	67 9	2 22	97 78	3 1
11	18 04	52 2	61.4	4	96	5.5
13 73	16 11	65 9	55 5	5 89	94 11	8
15.46	14 53	74 4	50.2	7.24	92 76	9 8
19 54	12 16	96 3	43	11.20	88 80	14 9
22 04	10 49	109	37.4	16 90	83.10	22 1
21.68	10 40	109	37 4	26 04	73 96	32.9
21 95	10.48	109	37 4	97 60	2.40	98 3
24 30	6.48	118.2	22.6	98.28	1.72	98.8

These authors also give data for the ammonium chloride carnellite and potassium chloride carnellite diagram at 25°.

SOLUBILITY OF MIXTURES OF AMMONIUM AND POTASSIUM CHLORIDES IN WATER AT 25°, 65° AND 90°.

(Uyeda, 1912.)

The results as presented by Uyeda show the percentage composition of the dissolved mixture and of the undissolved residue in the several cases, but not the quantity of salts dissolved. Mixed crystals were formed over certain ranges of concentration at each temperature.

Data for the cryohydric temperatures and composition of the saturated solutions of mixtures of the chlorides, nitrates and sulfates of ammonium, potassium and sodium are given by Mazatto (1891).

Solubility of Ammonium Chloride in Aqueous Solutions of Sodium Chloride Saturated with CO_2

(Fedotieff.)

t°.	Wt. of 1 cc. Sol.	Per 1000 cc. Solution: G. M. NaCl	G. M. NH_4Cl	Gms. NaCl	Gms. NH_4Cl	Per 1000 Gms. H_2O: G. M. NaCl	G. M. NH_4Cl	Gms. NaCl	Gms. NH_4Cl
0	1.069	0.0	4.60	0.0	246.1	0.0	5.57	0.0	298.0
0	1.185	4.04	2.26	236.5	121.0	4.89	2.73	286.4	146.1
15	1.077	0.0	5.29	0.0	283.1	0.0	6.64	0.0	355.0
15	1.097	0.81	4.71	47.5	252.1	1.02	5.91	59.8	316.4
15	1.120	1.68	4.13	98.0	221.7	2.09	5.18	122.4	277.0
15	1.153	2.87	3.38	168.0	180.7	3.57	4.20	208.9	224.7
15	1.175	3.65	2.98	213.5	159.4	4.55	3.72	266.8	198.8
30	...	...	...	...		0.0	7.78	0.0	416.4
30	1.166	3.30	3.70	193.0	198.0	4.26	4.77	249.0	255.4
45	...	...	...	...	...	0.0	9.03	0.0	483.7
45	...	...	...	...	...	4.0	6.02	233.9	322.1

Solubility of Ammonium Chloride in Aqueous Ethyl Alcohol at 15° and at 30°.

Gms. C_2H_5OH per 100 Gms. Solvent	Gms. NH_4Cl per 100 Gms. Solvent at 15°	30°
0	35.2	40.4
20	25	29.7
40	16.8	19
60	9.5	11.1
80	4	5.3
92.3	1.3	...
100	0.6	...

Results at 15° by interpolation from Gerardin (1865), Greenish (1900) and deBruyn (1892). Those at 30° from Bathrick (1896).

100 gms. absolute methyl alcohol dissolve 3.35 gms. NH_4Cl at 19°. (deBruyn, 1892.)

100 gms. 98% methyl alcohol dissolve 3.52 gms. NH_4Cl at 19.5°. (deBruyn, 1892.)

Solubility of Ammonium Chloride in Mixtures of Several Alcohols with Water.

(Armstrong, Eyre, Hussey and Paddington (1907), and Armstrong and Eyre (1910-11.)

t°.	Gm. Mols. Alcohol per 1000 Gms. H_2O	Gms. NH_4Cl per 100 Gms. Sat. Solution in Aq. CH_3OH	Aq. C_2H_5OH	Aq. C_3H_7OH
0	0	23	23	23
0	0.25	22.8	22.6	22.7
0	0.50	22.6	22.2	22.3
0	1	22.1	21.5	21.1
0	3	20.5	19	...
25	0	28.3	28.13 (1.0805)	28.3
25	0.25	28.1	28 (1.0780)	28.1
25	0.50	27.9	27.6 (1.0753)	27.5
25	1	27.6	27 (1.0704)	26.6
25	3	26.1	26.5 (1.0528)	...
25	5	...	22.6 (1.0370)	...

(Figures in parentheses show Sp. Gr. of sat. sols.)

SOLUBILITY OF AMMONIUM CHLORIDE IN SEVERAL ALCOHOL MIXTURES AT 25°.

(Herz and Kuhn, 1908.)

In Methyl and Ethyl Alcohol.		In Methyl and Propyl Alcohol.		In Propyl and Ethyl Alcohol.	
Gms. CH_3OH per 100 Gms. Solvent	Gms. NH_4Cl per 100 Gms. Sat. Solution	Gms. C_3H_7OH per 100 Gms. Solvent	Gms. NH_4Cl per 100 Gms. Sat. Solution	Gms. C_3H_7OH per 100 Gms. Solvent	Gms. NH_4Cl per 100 Gms. Sat. Solution.
0	0.53	0	2.76	0	0.53
10	0.67	10	2.33	10	0.50
20	0.80	20	1.90	20	0.47
30	0.98	30	1.58	30	0.42
40	1.18	40	1.26	40	0.39
50	1.40	50	1.03	50	0.36
60	1.65	60	0.82	60	0.32
70	1.92	70	0.60	70	0.30
80	2.18	80	0.41	80	0.26
90	2.48	90	0.30	90	0.22
100	2.76	100	0.18	100	0.18

SOLUBILITY OF AMMONIUM CHLORIDE IN AQUEOUS GLYCEROL SOLUTIONS AND IN AQUEOUS ACETONE SOLUTIONS AT 25°

(Herz and Knoch. Z. anorg. Chem. 45, 263, 267, '05.)

In Aqueous Glycerol.

(Sp. Gr. of Glycerine 1.255, Impurity about 1.5%.)

Wt. % Glycerine.	NH_4Cl per 100 cc. Solution, Millimols.	NH_4Cl per 100 cc. Solution, Grams.	Sp. Gr. at $\frac{25°}{4°}$.
0	585.1	31.32	1.0793
13.28	544.6	29.16	1.0947
25.98	502.9	26.93	1.1127
45.36	434.4	23.26	1.1452
54.23	403.5	21.60	1.1606
83.84	291.4	15.60	1.2225
100.00	228.4	12.23	1.2617

In Aqueous Acetone.

Vol. % Acetone.		NH_4Cl per 100 cc. Solution, Millimols.	NH_4Cl per 100 cc. Solution, Grams.	Sp. Gr. at $\frac{25°}{4°}$.
0		585.1	31.32	1.0793
10		534.1	28.59	1.0618
20		464.6	24.87	1.0451
30		396.7	21.23	1.0263
40		328.5	17.59	0.9998
*46.5	L	283.7	15.19	0.9800
*85.7	U	18.9	1.01	0.8390
90		9.4	0.50	0.8274

* Between these two concentrations of acetone, the solution separates into two layers. L indicates lower layer, U indicates upper layer.

100 cc. anhydrous hydrazine dissolve 75 gms. NH_4Cl at room temp. with evolution of ammonia. (Welsh and Broderson, 1915.)

SOLUBILITY OF TETRA ETHYL **AMMONIUM CHLORIDE** $N(C_2H_5)_4Cl$, AND ALSO OF TETRA METHYL AMMONIUM CHLORIDE $N(CH_3)_4Cl$ IN ACETONITRILE.

100 cc. sat. solution in CH_3CN contain 29.31 gms. $N(C_2H_5)_4Cl$ at 25°.
100 cc. sat. solution in CH_3CN contain 0.265 gms. $N(CH_3)_4Cl$ at 25°.

(Walden. Z. physik. Chem. 55, 712, '06.)

SOLUBILITY OF TETRA ETHYL AMMONIUM CHLORIDE IN WATER AND IN CHLOROFORM.

(Peddle and Turner, 1913.)

100 gms. H_2O dissolve 141.0 gms. $N(C_2H_5)_4Cl$ at 25°.
100 gms. $CHCl_3$ dissolve 8.24 gms. $N(C_2H_5)_4Cl$ at 25°.

SOLUBILITY OF DIMETHYL **AMMONIUM CHLORIDE** IN WATER AND IN CHLOROFORM.

(Hantzsch, 1902.)

100 gms. H_2O dissolve 208 gms. of the salt.
100 gms. $CHCl_3$ dissolve 26.9 gms. of the salt (temp. not stated in abstract).

AMMONIUM CHROMATES.

SOLUBILITY IN WATER AT 30°.

(Schreinemaker — Z physic. Chem. 55, 89, '06)

Composition in Wt per cent of: The Solution % CrO_3.	% NH_3	The Residue % CrO_3.	% NH_3.	Solid Phase.
6.933	22.35	. .	. . .	$(NH_4)_2CrO_4$
9.966	16.53	47.59	20.44	"
16.973	8.20	. .	. . .	"
22.53	6.37	38.03	12.15	"
27.09	6.87	48.02	12.01	$(NH_4)_2CrO_4+(NH_4)_2Cr_2O_7$
26.19	5.70	47.38	8.81	$(NH_4)_2Cr_2O_7$
25.99	5.10	41.56	7.58	"
30.16	3.50	.	.	"
38.89	3.10	61.08	8.80	"
42.44	3.15	59.72	6.75	$(NH_4)_2Cr_2O_7+(NH_4)_2Cr_3O_{10}$
44.08	2.27	54.90	4.14	$(NH_4)_2Cr_3O_{10}$
52.91	1.11	60.88	3.09	"
54.56	1.03	63.07	3.09	$(NH_4)_2Cr_3O_{10}+(NH_4)_2Cr_4O_{13}$
56.57	0.97	65.70	2.95	$(NH_4)_2Cr_4O_3$
58.87	0.65	69.74	3.24	"
62.48	0.46	71.93	3.10	"
63.60	0.40	73.68	1.18	$(NH_4)_2Cr_4O_{13}+CrO_3$
63.66	0.41	71.47	2.07	"
62.94	0.21	. . .	. .	CrO_3
62.28	0.0	. .	. . .	CrO_3

100 gms. of the sat. aq. solution contain 28.80 gms $(NH_4)_2CrO_4$ at 30°.
100 gms. of the sat. aq. solution contain 32.05 gms $(NH_4)_2Cr_2O_7$ at 30°.

AMMONIUM CITRATES.

SOLUBILITY IN AQUEOUS SOLUTIONS OF CITRIC ACID AT 30°.

(van Itallie, 1908)

(Data read from curve plotted from original results.)

Gms per 100 Gms Sat Sol $C_6H_8O_7$	NH_3	Solid Phase	Gms per 100 Gms Sat Sol $C_6H_8O_7$	NH_3	Solid Phase
65	0	$C_6H_8O_7.H_2O$	53	7.5	$C_6H_7O_7NH_4$
68	0.5	"	56	8.2	"
72	1.3	"	59.1	8.5	$C_6H_7O_7NH_4+C_6H_6O_7(NH_4)_2$
75	2.3	$C_6H_8O_7.H_2O+C_6H_7O_7NH_4$	54	8.5	$C_6H_6O_7(NH_4)_2$
70	2.4	$C_6H_7O_7NH_4$	50	7.9	"
65	2.5	"	45.8	8.4	"
60	2.7	"	47	11.1	"
55	2.8	"	50	12.9	"
52	2.8	"	54.5	14.5	$C_6H_6O_7(NH_4)_2+C_6H_5O_7(NH_4)_3.?H_2O$
50	3.6	"	52	15	$C_6H_5O_7(NH_4)_3.?H_2O$
49.2	5.1	"	50	16	"
50	6.2	"	48.4	17.9	"

Composition of the solid phases determined by "Rest Method."

(Schreinemakers, Z anorg Ch 37, 207)

AMMONIUM CALCIUM FERROCYANIDE.

100 gms. sat. aqueous solution contain 0.258 gm. $(NH_4)_2CaFe(CN)_6$ at 16°. (Brown)

AMMONIUM FLUOBORIDE $NH_4.3BF_3$.

100 parts of water dissolve 25 parts salt at 16°, and about 97 parts at b. pt.

(Stolba — Chem Techn Cent Anz 7, 459)

AMMONIUM FORMATE $HCOONH_4$, and also Ammonium Acid Formate.

SOLUBILITY IN WATER.
(Groschuff – Ber 36, 1351, '03)

t°.	Gms $HCOONH_4$ per 100 Gms Solution	Gms $HCOONH_4$ per 100 Gms Water	Solid Phase	t°	Gms per 100 Gms Solution $HCOONH_4$	Gms per 100 Gms Solution HCOOH.	Solid Phase
−20	41.9	72	$HCOONH_4$	−6.5	46.7	34.1	$HCOONH_4.HCOOH$
0	50.5	102	"	+1.5	49.6	36.2	"
20	58.9	143	"	6	51.3	37.4	"
40	67.1	204	"	8.5	52.1	38	"
60	75.7	311	"	−7	49.6	36.2	$HCOONH_4$ labil
80	84.2	531	"	+13	53	38.6	" stabil
116 m. pt.				29	55.8	40.7	" "
				39	57.8	42.2	H_2O free solution

SOLUBILITY OF AMMONIUM FORMATE IN FORMIC ACID SOLUTIONS.
(Groschuff.)

30 grams of $HCOONH_4$ dissolved in weighed amounts of anhydrous formic acid and cooled to the point at which a solid phase separated.

t°.	Gms $HCOONH_4$ per 100 Gms Solution	G. M. $HCOONH_4$ per 100 G. M. HCOOH	Solid Phase	t°.	Gms $HCOONH_4$ per 100 Gms Solution	G. M. $HCOONH_4$ per 100 G. M. HCOOH	Solid Phase.
−3	35.3	39.9	$HCOONH_4$ HCOOH	11	50	73	$HCOONH_4$ labil.
+8.5	40.6	49.9	"	39	57.8	100	" stabil
21.5	50	73	"	78	73.1	199	" "
				116 m. pt.	100	∞	" "

100 gms. 95% Formic Acid dissolve 6.2 gms. $HCOONH_4$ at 21°. (Aschan, 1913)

AMMONIUM IODATE NH_4IO_3.

SOLUBILITY IN AQUEOUS IODIC ACID AT 30°.
(Meerburg, 1905.)

Gms per 100 Gms Sat. Sol. HIO_3	Gms per 100 Gms Sat. Sol. NH_4IO_3	Solid Phase	Gms per 100 Gms Sat. Sol. HIO_3	Gms per 100 Gms Sat. Sol. NH_4IO_3	Solid Phase
0	4.20	NH_4IO_3	24	0.62	$NH_4IO_3.2HIO_3$
2.54	3.89	"	44.43	0.39	"
4.52	3.83	" + $NH_4IO_3.2HIO_3$	76.35	0.31	" + HIO_3
6.57	1.94	$NH_4IO_3.2HIO_3$	76.70	0	HIO_3

AMMONIUM Per IODATE NH_4IO_4.

100 gms. H_2O dissolve 2.7 gms. salt at 16°, d_{16} = 1.078. (Barker, 1908)

AMMONIUM IODIDE NH_4I.

SOLUBILITY IN WATER.
(Smith and Eastlack, 1916.)

t°	Gms NH_4I per 100 Gms H_2O	t°	Gms NH_4I per 100 Gms H_2O
−27.5 Eutec.	125.2	40	190.5
−20	136	50	199.6
−10	145	60	208.9
0	154.2	70	218.7
10	163.2	80	228.8
15	167.8	100	250.3
20	172.3	120	273.6
25	176.8	140	299.2
30	181.4		

SOLUBILITY IN AQUEOUS ALCOHOL AT 25°.
(Seidell, unpublished.)

Gms C_2H_5OH per 100 Gms Solvent	d_{25} of Sat. Sol.	Gms NH_4I per 100 Gms Sat. Sol.	Gms NH_4I per 100 Gms Solvent
0	1.646	64.5	181.9
10	1.590	61.7	161.1
20	1.525	58.7	142.1
30	1.462	55.5	124.8
40	1.395	52	108.3
50	1.320	48	92.3
60	1.250	43.8	77.9
70	1.168	39	64
80	1.094	33.3	49.0
90	1.013	27.5	37.9
100	0.929	20.8	26.3

Tetra Ethyl **AMMONIUM IODIDE** $N(C_2H_5)_4I$.

SOLUBILITY IN SEVERAL SOLVENTS.

(Walden — Z physik Chem **55**, 698, '06)

Solvent.	Formula	t°	Sp Gr of Solution	Gms $N(C_2H_5)_4I$ per 100 cc Solution	Gms Solution
Water	H_2O	0	1.0470	16.31	15.58
Water	H_2O	25	1.1021	36.33 (35.5)	32.9
Methyl Alcohol	CH_3OH	0	0.8326	3.7-4.3	4.44
Methyl Alcohol	CH_3OH	25	0.8463	10.5 (10.7)	12.26
Ethyl Alcohol	C_2H_5OH	0	0.7928	0.348	0.439
Ethyl Alcohol	C_2H_5OH	25	0.7844	0.98 (0.88)	1.113
Glycol	$(CH_2OH)_2$	0	1.1039	3.27	2.97
Glycol	$(CH_2OH)_2$	25	1.0904	7.63 (7.55)	7
Acetonitrile	CH_3CN	0	0.8163	2.24	2.74
Acetonitrile	CH_3CN	25	0.7929	2.97 (3.54)	3.74
Propionitrile	CH_3CH_2CN	0	0.8059	0.618	0.767
Propionitrile	CH_3CH_2CN	25	0.7830	0.81-1.01	0.99
Benzonitrile	C_6H_5CN	25	..	0.467	0.451
Methyl Sulphocyanide	CH_3SCN	25	1.0828	4.40	4.06
Ethyl Sulphocyanide	C_2H_5SCN	25	1.0012	0.475	0.47
Nitro Methane	CH_3NO_2	0	1.1658	3.50	3.004
Nitro Methane	CH_3NO_2	25	1.1476	5.38-6.27	4.72
Nitroso Dimethyline	$(CH_3)_2N.NO$	25	1.0059	2.67	2.66
Acetyl Acetone	$CH_3COCH_2COCH_3$	25		0.268	...
Furfurol	$C_4H_3O.COH$	0	1.1738	3.91	3.33
Furfurol	$C_4H_3O.COH$	25	1.1692	5.33	4.55
Benzaldehyde	C_6H_5COH	25	. .	0.43	. .
Salicylaldehyde	$C_6H_4.OH.COH$	25	.	change-able—17.7	...
Anisaldehyde	$C_6H_4.OCH_3.COH$	25	. .	0.59	.
Acetone	$(CH_3)_2CO$	0	0.7991	0.174	0.218
Acetone	$(CH_3)_2CO$	25		0.249	0.316
Ethyl Acetate	$CH_3COOC_2H_5$	25		0.00039	
Ethyl Nitrate	$C_2H_5ONO_2$	25	1.0984	0.062	0.056
Benzoyl Ethyl Acetate	$C_6H_5COCH_2COOC_2H_5$	25	1.1303	0.321	0.284
Dimethyl Malonate	$CH_2(COOCH_3)_2$	25	1.1335	0.040	0.035
Methyl Cyan Acetate	$CH_2CNCOOCH_3$	0	1.1341	1.82	1.605
Methyl Cyan Acetate	$CH_2CNCOOCH_3$	25	.	2.83	. .
Ethyl Cyan Acetate	$CH_2CNCOOC_2H_5$	0	1.0760	1.057	0.981
Ethyl Cyan Acetate	$CH_2CNCOOC_2H_5$	25	1.0607	1.71	1.41
Nitrobenzene	$C_6H_5NO_2$	25	...	0.504	0.422
Acetophenone	$C_6H_5COCH_3$	..	.	0.13	0.127
Amyl Alcohol	$C_5H_{11}OH$	..	.	0.071	0.089
Paraldehyde	$(C_2H_4O)_3$	..	..	0.036	0.037
Methyl Formate	$HCOOCH_3$	..	..	0.031	0.032
Bromobenzene	C_6H_5Br		.	0.009	0.006

(Walden — Z physik Chem **61**, 635, 1907-'08.)

Tetra Methyl **AMMONIUM IODIDE** $N(CH_3)_4I$.

SOLUBILITY IN SEVERAL SOLVENTS.
(Walden — Z. physik. Chem. 55, 708, '06.)

Solvent.	Formula	t°.	Sp. Gr. of Solution	Gms. $N(CH_3)_4I$ per 100 cc. Solution.	Gms. $N(CH_3)_4I$ per 100 Gms. Solution
Water	H_2O	0	1.0188	2.01	1.97
Water	H_2O	25	1.0155	5.31-5.89	5.22
Methyl Alcohol	CH_3OH	0	0.8025	0.18-0.22	0.22
Methyl Alcohol	CH_3OH	25	0.7920	0.38-0.42	0.48
Ethyl Alcohol	C_2H_5OH	25	0.7894	0.09	
Glycol	$(CH_2OH)_2$	0	.	1.014	...
Glycol	$(CH_2OH)_2$	25	1.0678	0.240	0.224
Acetonitril	CH_3CN	25		0.650	.
Nitro Methane	CH_3NO_2	0	1.1387	0.25-0.32	0.22
Nitro Methane	CH_3NO_2	25	1.1285	0.34-0.38	0.21
Acetone	$(CH_3)_2CO$	0	.	0.118	.
Acetone	$(CH_3)_2CO$	25	.	0.187	.
Salicyl Aldehyde	$C_6H_4.OH.COH$	0	1.1492	0.302	0.263
Salicyl Aldehyde	$C_6H_4.OH.COH$	25	1.1379	0.510	0.484

Very exact determinations of the solubility of tetra methyl ammonium iodide in aqueous solutions of KOH and of NH_4OH at 25° are given by Hill (1917).

Tetra Propyl **AMMONIUM IODIDE** $N(C_3H_7)_4I$.

SOLUBILITY IN SEVERAL SOLVENTS.
(Walden — Z. physik. Chem. 55, 709, '06.)

Solvent	Formula	t°.	Sp. Gr. of Solution	Gms. $N(C_3H_7)_4I$ per 100 cc. Solution	Gms. $N(C_3H_7)_4I$ per 100 Gms. Solution
Methyl Alcohol	CH_3OH	0	0.9756	40.92	41.94
Methyl Alcohol	CH_3OH	25	1.0187	56.42	55.37
Ethyl Alcohol	C_2H_5OH	0	0.8349	6.5-6.8	8.14
Ethyl Alcohol	C_2H_5OH	25	0.8716	19.88-20.29	23.28
Acetonitrile	CH_3CN	0	0.8553	13.03	15.24
Acetonitrile	CH_3CN	25	0.8584	18.69	21.77
Propionitrile	C_2H_5CN	0	0.8280	6.37	7.66
Propionitrile	C_2H_5CN	25	0.8191	9.65	10.29
Benzonitrile	C_6H_5CN	25	1.0199	8.44	8.35
Nitro Methane	CH_3NO_2	0	1.181	14.79	12.52
Nitro Methane	CH_3NO_2	25	1.158	22.24	19.21
Nitro Benzene	$C_6H_5NO_2$	25	1.193	5.71	4.79
Benzaldehyde	C_6H_5COH	0	1.0581	7.06	6.67
Benzaldehyde	C_6H_5COH	25	1.0549	9.87	9.35
Anisaldehyde	$C_6H_5.OCH_3.COH$	0	1.1114	5.60	5.04
Anisaldehyde	$C_6H_5.OCH_3.COH$	25	1.1004	6.75	6.14
Salicylaldehyde	$C_6H_5.OH.COH$	25	...	39.28	...
Ethylnitrite	$C_2H_5NO_2$	0	1.1207	0.522	0.466
Ethylnitrite	$C_2H_5NO_2$	25	1.1025	0.653	0.592
Dimethyl Malonate	$CH_2(COOCH_3)_2$	0	1.1532	0.298	0.259
Dimethyl Malonate	$CH_2(COOCH_3)_2$	25	1.1345	0.320	0.282
Acetone	$(CH_3)_2CO$	0	0.8259	2.692	4.65
Acetone	$(CH_3)_2CO$	25	0.8049	3.944	4.90
Ethyl Acetate	$CH_3COOC_2H_5$	25	0.8975	0.0063	0.007
Ethyl Bromide	C_2H_5Br	25	...	...	0.187

(Walden — Z. physik. Chem. 61, 639, 1907-'08.)

SOLUBILITY OF TETRA AMYL, TETRA ETHYL AND TETRA α PROPYL AMMONIUM IODIDES IN WATER AND IN CHLOROFORM AT 25°. (Peddle and Turner, 1913)

Solvent	Gms Each Salt (Determined Separately), per 100 Gms Solvent		
	$N(C_5H_{11})_4I$	$N(C_2H_5)_4I$	$\alpha N(C_3H_7)_4I$
Water	0 74	45	18 64
$CHCl_3$	210 8	1 55	54 56

Freezing-point data for mixtures of tetra methyl ammonium iodide and iodine, and for phenyltrimethyl ammonium iodide and iodine are given by Olivari (1908).

AMMONIUM Iridium CHLORIDES.

SOLUBILITY IN WATER AT 19°. (Delepine, 1908)

Name of Salt	Formula	Gms per 100 Gms H_2O
Ammonium iridium chloride	$(NH_4)_2IrCl_6$	0 77
Diammonium aquo penta chloro iridite	$IrCl_5(H_2O)(NH_4)_2$	15 4
Triammonium hexa chloro iridite	$IrCl_6(NH_4)_3+H_2O$	10 5

AMMONIUM Iodo MERCURATE $2NH_4I\,HgI_2\,H_2O$

100 gms of the saturated aqueous solution contain 4 5 gms. NH_4, 22 6 gms. Hg and 62 3 gms I at 26°, sp gr. = 2 98 (Dubois, 1905)

AMMONIUM Tetra MOLYBDATE $(NH_4)_2O\,4MoO_3\,2H_2O$

100 gms H_2O dissolve 3 52 gms salt at 15° (d = 1 03), 3 67 gms at 18° (d = 1.04) and 4 60 gms at 32° (d = 1 05) (Wempe, 1912)

AMMONIUM Phospho MOLYBDATE $(NH_4)_3PO_4\,14MoO_3\,4H_2O$

SOLUBILITY IN WATER AND AQUEOUS SOLUTIONS AT 15°. (de Lucchi, 1910)

Solvent	Gms Salt per 1000 Gms Solvent.
Water	0 238
5 per cent aqueous NH_4NO_3 solution	0.137
1 per cent aqueous HNO_3 solution	0 203

AMMONIUM NITRATE NH_4NO_3.

SOLUBILITY IN WATER.

(Schwarz — Ostwald's Lehrbuch, 2d ed p 425, Müller and Kaufmann — Z. physik. Chem 42, 497, '01–'02)

t°	Sp Gr Solution	G. Mols NH_4NO_3 per 100 Mols H_2O	Gms NH_4NO_3 per 100 Gms Solution	Gms NH_4NO_3 per 100 Gms Water	Solid Phase.
0		26 63	54 19	118 3	NH_4NO_3 rhomb. β
12 2	1 2945	34 50	60 53	153 4	"
20 2	1 3116	43 30	65 80	192 4	"
25 0	1 3197	48 19	68 17	214 2	"
30 0	1 3299	54 40	70 73	241 8	"
32 1	1 3344	57 60	71 97	256 9	NH_4NO_3 rhomb. β + rhomb. α
35 0	1 3394	59 80	72 64	265 8	NH_4NO_3 rhomb. α
40 0	1 3464	66 80	74 82	297 0	"
50 0	...	77 41	77 49	344 0	"
60 0	...	94 73	80 81	421 0	"
70.0	...	112 30	83 32	499 0	"
80 0	...	130 50	85 25	580 0	"
90 0	...	166 50	88 08	740 0	NH_4NO_3 rhombohedral?
100 0	..	196 00	89 71	871 0	"

SOLUBILITIES OF MIXTURES OF AMMONIUM NITRATE AND OTHER SALTS. (Rüdorff – Mulder)

100 gms. H_2O dissolve 162 9 gms NH_4NO_3 + 77 1 gms. $NaNO_3$ at 16° R.
100 gms. H_2O dissolve 88.8 gms. NH_4NO_3 + 40.6 gms. KNO_3 at 9° M.
100 gms. H_2O dissolve 101 3 gms NH_4NO_3 + 6.2 gms. $Ba(NO_3)_2$ at 9° M.

Solubility of Ammonium Nitrate in Ammonia.

(Kuriloff — Z. physic. Chem. 25, 109, '98)

t°.	Gms. NH_4NO_3.	Gms. NH_3	Mols NH_4NO_3 per 100 Mols. NH_4NO_3 + NH_3.	t°	Gms NH_4NO_3.	Gms NH_3	Mols NH_4NO_3 per 100 Mols. NH_4NO_3 + NH_3.
−80	0	100	0.0	33.3	0.9358	0.2352	45.9
−60	1.3918	4.4327	6.25	35.9	0.7746	0.1857	47.0
−44.5	0.9526	1.2457	13.9	68.8	4.2615	0.7747	53.8
−30	0.8308	0.3700	32.3	94.0	0.6439	0.0665	67.3
−10.5	0.9675	0.3515	36.9	190.8	0.7578	0.0588	74.2
0	0.7600	0.2607	38.3	168.0	..	..	100.0

t° = temperature of equilibrium between solution and solid phase

Solubility of Ammonium Nitrate in Aqueous Solutions of Ammonium Sulfate and Vice Versa.

(Massink, 1916, 1917)

Results at 0°. (de Waal, 1910)			Results at 30°. (Schreinemakers and Haenen, 1910)			Results at 70°. (de Waal, 1910)		
Gms per 100 Gms Sat Sol NH_4NO_3	$(NH_4)_2SO_4$	Solid Phase	Gms per 100 Gms Sat Sol NH_4NO_3	$(NH_4)_2SO_4$	Solid Phase.	Gms per 100 Gms Sat Sol. NH_4NO_3	$(NH_4)_2SO_4$	Solid Phase
54.19	0	NH_4NO_3	70.1	0	NH_4NO_3	84.03	0	NH_4NO_3
49.12	6	"	67.63	2.38	"	81.38	2.41	"
45.99	9.53	NH_4NO_3+1.3	66.03	3.46	NH_4NO_3+1.3	81.01	2.45	NH_4NO_3+1.3
31.61	19.5	1.3	63.84	4.96	1.3	80.25	2.68	1.3
30.87	20.43	1.3+1.2	58.06	8.22	1.3+1.2	76.01	3.96	"
31.04	20.4	1.2	52.75	11.42	1.2	73.18	5.14	1.3+1.2
29.81	21.33	"	49.80	13.27	" +$(NH_4)_2SO_4$	71.58	5.82	1.2
29.58	41.64	1.2+$(NH_4)_2SO_4$	37.20	19.48	$(NH_4)_2SO_4$	70.15	6.71	1.2+$(NH_4)_2SO_4$
5.61	37.89	$(NH_4)_2SO_4$	19.01	28.83	"	11.10	40.81	$(NH_4)_2SO_4$
0	41.4	"	12.05	34.7	"	0	47.81	"
			0	44.1	"			

1.3 = $(NH_4)_2SO_4.3NH_4NO_3$. 1.2 = $(NH_4)_2SO_4.2NH_4NO_3$.

Freezing-point lowering data for mixtures of ammonium nitrate and lead nitrate are given by Bogitch (1915).

Solubility of Ammonium Nitrate in Nitric Acid.

(Groschuff — Ber. 37, 1488, '04)

Determinations by the "Synthetic Method," see Note, page 16.

t°	Gms NH_4NO_3 per 100 Gms. Sol	Mols NH_4NO_3 per 100 Mols HNO_3.	Solid Phase.	t°.	Gms NH_4NO_3 per 100 Gms Sol	Mols NH_4NO_3 per 100 Mols HNO_3	Solid Phase
8	21.1	21.1	$NH_4NO_3.2HNO_3$	11.0	51.7	84.3	$NH_4NO_3.HNO_3$
23	28.7	31.6	" *a*	12.0	54.7	95.1	" labil
29.5 m pt.	38.8	50.0	"	11.5	57.6	108.0	" *b*
27.5	44.6	63.4	" *b*	11.5	54.0	92.4	NH_4NO_3 labil.
23.5	49.4	76.8	"	17.0	51.7	95.1	" stabil.
17.5	54.0	92.4	"	27.0	56.2	101.0	"
16.5	54.3	93.5	"	49.0	60.4	120.0	"
4.0	45.8	66.7	$NH_4NO_3.HNO_3$ labil	79.0	68.1	168.0	"

a = solution in HNO_3, *b* = solution in NH_4NO_3.

Solubility of Ammonium Tri-Nitrate in Water.

(Groschuff.)

t°.	Gms. NH_4NO_3 per 100 Gms Solution	Gms HNO_3 per 100 Gms Solution	Mols NH_4NO_3* per 100 Mols. H_2O	Mols NH_4NO_3 per 100 total Mols Solution	Solid Phase.
− 8	34.2	53.9	64.3	22	$NH_4NO_3.2HNO_3$
− 2.5	34.8	54.8	75.1	23.1	"
+ 3	35.4	55.8	90	24.3	"
8.5	36.6	56.9	113	25.7	"
19.5	37.4	58.9	225	29	"
25	38.1	60	450	31	"
29.5 m. pt.	38.8	61.2	∞	33	"

* or $NH_4NO_3.2HNO_3$.

Solubility of Mixtures of Ammonium Nitrate and Silver Nitrate in Water at Various Temperatures.

(Schreinemakers and de Baat, 1910.)

t°	Gms per 100 Gms Sat. Sol. $AgNO_3$	Gms per 100 Gms Sat. Sol. NH_4NO_3	Solid Phase.	t°	Gms per 100 Gms Sat. Sol. $AgNO_3$	Gms per 100 Gms Sat. Sol. NH_4NO_3	Solid Phase.
− 7.3	47.1	0	Ice + rb $AgNO_3$	100.6	67.9	32.1	D + rb $AgNO_3$
− 10.7	44.52	8.43	"	0	22.13	44.87	D + rb NH_4NO_3
− 14.9	42	16.8	Ice + D + rb $AgNO_3$	18	27.07	49.22	"
− 14.8	39.51	18.79	" + D	30	29.76	52.50	"
− 18.7	15.09	37.3	" + D + β rb NH_4NO_3	± 32			D + rb NH_4NO_3 + α + rb NH_4NO_3
− 17.4	0	41.[illegible]	" + rb NH_4NO_3	40	32.68	52.22	D + α rb. NH_4NO_3
0	50.36	19.59	D + rb $AgNO_3$	55	36.6	52.38	"
18	55.36	22.06	"	85.4			D + rb NH_4NO_3 + rbd NH_4NO_3
30	58.89	23.42	"				
55	63.32	26.12	"	101.5	47.5	52.5	D + rbd NH_4NO_3

D = $NH_4NO_3.AgNO_3$. rb. = rhombic. rbd. = rhombohedric.

Solubility of Ammonium Nitrate in Aqueous Solutions of Silver Nitrate and Vice Versa at 30°.

(Schreinemakers and de Baat, 1910.)

Gms per 100 Gms Sat. Sol. $AgNO_3$	Gms per 100 Gms Sat. Sol. NH_4NO_3	Solid Phase.	Gms per 100 Gms Sat. Sol. $AgNO_3$	Gms per 100 Gms Sat. Sol. NH_4NO_3	Solid Phase.
0	70.1	NH_4NO_3	45.85	34.47	D
12.51	63.59	"	52.45	28.86	"
21.31	58.64	"	57.93	24.33	"
27.75	54.12	"	58.88	23.42	D + $AgNO_3$
29.76	52.5	NH_4NO_3 + D	63.27	15.62	$AgNO_3$
35.62	45.44	D	69.08	6.59	"
41.09	39.60	"	73	0	"

D = $NH_4NO_3.AgNO_3$.

Results are also given by Schreinemakers (1908–09) for the reciprocal solubility of ammonium nitrate and silver nitrate in aqueous alcohol solutions at 30°.

100 cc. anhydrous hydrazine dissolve 78 gms. NH_4NO_3 at room temp. with decomp. (Welsh and Broderson, 1915.)

Freezing-point data for mixtures of ammonium nitrate and silver nitrate are given by Flavitzkii (1909) and by Zawidzki (1904). The eutectic is at 102.4° and 30.9 Mol. % $AgNO_3$. Results for NH_4NO_3 + $TlNO_3$ are given by Boks (1902).

RECIPROCAL SOLUBILITY OF AMMONIUM NITRATE AND SODIUM NITRATE IN WATER AT 0°, 15° AND 30°.

(Fedotieff and Koltunoff, 1914.)

t°.	Sp Gr Sat. Sol.	Gms per 100 Gms H_2O.		t°.	Sp Gr Sat. Sol.	Gms. per 100 Gms. H_2O	
		NH_4NO_3	$NaNO_3$			NH_4NO_3.	$NaNO_3$.
0	1.354	0	73.33	15	1.429	155.3	75.38
0	1.407	105.5	66	15	1.405	156.1	60.76
0	1.264	118.4	0	15	1.364	159	36.50
15	1.375	0	83.9	15	1.350	160	27.79
15	1.386	24.03	81.21	15	1.330	162.3	17.63
15	1.392	42.81	79.34	15	1.298	167.4	0
15	1.401	64.6	78.06	30	1.401	0	96.12
15	1.417	110.9	75.81	30	1.450	220.8	88.31
15	1.428	152	75.35	30	1.329	232.6	0

SOLUBILITY OF AMMONIUM NITRATE IN AQUEOUS ETHYL ALCOHOL.

(Fleckenstein — Physik Z., 6, 419, '05.)

t°	Grams of NH_4NO_3 Dissolved per 100 Grams Aq Alcohol of (Wt %):					
	100%	86.77%.	76.12%	51.65%.	25.81%.	0%.
20	2.5	11	23	70	140	195
30	4	14	32	90	165	230
40	5	18	43	115	196	277
50	6	24	55	144	244	365
60	7.5	30	70	183	320	...
70	9	41	93	230	...	...
80	10.5	56	...	...	...	...

NOTE.—The figures in the preceding table were read from curves shown in the abridged report of the work, and are, therefore, only approximately correct. Determinations of the solubility in methyl alcohol solutions were also made but not quoted in the abstract. The "Synthetic Method" (see Note, page 16) was used.

100 grams absolute ethyl alcohol dissolve 4.6 grams NH_4NO_3 at 14° and 3.8 grams at 20.5°.

100 grams absolute methyl alcohol dissolve 14.6 grams NH_4NO_3 at 14°, 16.3 grams at 18.5° and 17.1 grams at 20.5°.

(Schiff and Monsacchi — Z physik Chem., **21**, 277, '96, at 20.5° de Bruyn — *Ibid.*, **10**, 783, '92.)

SOLUBILITY OF AMMONIUM NITRATE IN AQUEOUS ETHYL AND METHYL ALCOHOLS AND IN A MIXTURE OF THE TWO AT 30°.

(Schreinemakers, 1908-09.)

Gms per 100 Gms Sat Sol			Gms per 100 Gms Sat Sol			Gms per 100 Gms Sat Sol		
H_2O	C_2H_5OH.	NH_4NO_3.	H_2O.	CH_3OH.	NH_4NO_3	H_2O	*CH_3OH +C_2H_5OH	NH_4NO_3.
0	96.4	3.6	0	83.3	16.7	3.4	84.9	11.7
5	89.6	6.5	5	74.8	21.3	5	82.9	12.3
10	80.4	10.7	10	63.8	27.1	10	74.6	16.4
15	68.6	17	15	50.7	35	15	63.5	24
20	53.5	26.8	20	35.2	46.3	20	48.2	35.1
25	32.5	44.8	25	19.8	59	25	22.4	54
29.9	0	70.1	29.9	0	70.1	29.9	0	70.1

* Weight per cent CH_3OH = 51.7, C_2H_5OH = 48.3.

Additional determinations of the solubility of ammonium nitrate in aqueous ethyl alcohol solutions at 0°, 30° and 70° are given by deWaal (1910). At certain concentrations at 67.5° the solutions separate into two layers.

AMMONIUM Magnesium **NITRATE** $2NH_4NO_3.Mg(NO_3)_2$.

100 parts water dissolve 10 parts salt at 12.5°. ([illegible])

AMMONIUM Manganic **MOLYBDATE** $5(NH_4)_2MoO_4.Mn_2(MoO_4)_3.12H_2O$.

100 parts water dissolve 0.98 part salt at 17°. (Struve, J. pr. Chem., 61, [illegible])

AMMONIUM OLEATE $C_{17}H_{33}COONH_4$.

SOLUBILITY IN SEVERAL SOLVENTS.
(Falciola, 1910.)

Solvent	Gms. $C_{17}H_{33}COONH_4$ dissolved per 100 cc. solvent.		
Absolute Alcohol	31 at 0°	50 at 10°	100 at 50°
75 per cent Alcohol	..	8.2 at 20°	10.80 at 30°
1 part Alcohol + 2 parts Ether	..	9.45 at 15°	16.9 at 20°
Acetone	...	4.7 at 15°	.

AMMONIUM OXALATE $(COONH_4)_2.H_2O$

SOLUBILITY IN WATER.
(Av. curve from results of Engel, 1888, Foote and Andrew, 1905, Woudstra, 1912, Colani, 1916.)

t°.	Gms. $(COONH_4)_2$ per 100 Gms. Sat. Solution.	t°.	Gms. $(COONH_4)_2$ per 100 Gms. Sat. Solution.
0	2.1	25	4.8
10	3	30	5.6
15	3.5	40	7.4
20	4.2	50	9.3

SOLUBILITY IN AQUEOUS SOLUTIONS OF OXALIC ACID.
(Woudstra, 1912.)

Results at 30° (Interpolated from Original.)			Results at 45°.		
Gms. per 100 Gms. Sat. Sol. $(COONH_4)_2$.	Gms. per 100 Gms. Sat. Sol. $(COOH)_2$.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. $(COONH_4)_2$.	Gms. per 100 Gms. Sat. Sol. $(COOH)_2$.	Solid Phase.
0.14	12.36	A	0.22	21.22	A
0.28	12.78	A+T	0.31	21.31	"
0.30	12	T	0.53	20.54	A+T
0.39	10	"	0.56	21.23	T
0.47	8	"	0.61	20.55	"
0.52	7	"	0.54	20.92	"
0.68	6	"	0.79	16.44	"
1	5	"	1.23	12.88	"
2	3.96	"	7.16	7.98	"
3	3.61	"	3.54	5.83	"
4	3.60	"	5.65	5.67	"
5	3.81	"	6.72	5.95	"
5.98	4.21	T+A. O.	8.74	6.53	T+A. O.
7	3.63	A. O.	8.93	6.27	A. O.
8.19	3.36	A. O.+N. O.	9.04	6.14	"
7	2.32	N. O.	12.38	5	A. O.+N. O.
6	1.02	"	8.31	3.04	N. O.
5.53	0.22	"	9.59	1.45	"

A. = Oxalic Acid $(COOH)_2.H_2O$.
A. O. = Acid Ammonium Oxalate $(COO)_2HNH_4.H_2O$.
T = Ammonium tetroxalate $(COOH)_2.(COO)_2HNH_4.2H_2O$.
N. O. = Neutral Ammonium Oxalate $(COONH_4)_2.H_2O$.

Additional data for this system at 25° are given by Walden (1905), and at 0°, by Engel (1888).

SOLUBILITY IN WATER OF MIXTURES OF AMMONIUM OXALATE AND:

Other Oxalates at 25°. (Foote and Andrew, 1905.)			Other Ammonium Salts. (Colani, 1916.)		
Gms per 100 Gms Sat Solution		t°.	Gms. per 100 Gms. Sat Solution.		
2.79 $(COONH_4)_2H_2O$	+25.96 $(COOK)_2H_2O$	15	0.14 $(COONH_4)_2$	+26.35	NH_4Cl
4.8 "	+5.75 $(COOLi)_2$	50	0.67 "	+32.55	"
5.45 "	+0.59 $(COO)_2Mg\ 2H_2O$	18	0.11 "	+42.43	$(NH_4)_2SO_4$
6.19 "	+1.45 $(COO)_2Zn\ 2H_2O$	50	0.65 "	+45.92	"
5.06 "	+0.28 $(COO)_2Cd\ 3H_2O$	19	0.085 "	+62.26	NH_4NO_3
		50	0.35 "	+72.11	"

Both salts in excess in every case. No double salts formed.

SOLUBILITY OF AMMONIUM OXALATE AND OF AMMONIUM THORIUM OXALATE IN WATER AT 25°.

(James, Whittemore and Holden, 1914.)

The mixtures were constantly agitated for periods varying from many weeks to several months.

Gms per 100 Gms H_2O $(NH_4)_2C_2O_4$.	$Th(C_2O_4)_2$	Solid Phase	Gms per 100 Gms H_2O $(NH_4)_2C_2O_4$.	$Th(C_2O_4)_2$.	Solid Phase.
5.25	0	$(NH_4)_2C_2O_4$	29.47	39.10	2.1.7+2.1.2
6.04	1.54	"	23.04	29.87	2.1.2
7.78	4.51	"	16.84	21.18	"
10.37	8.87	"	13.27	15.96	"
15.46	16.89	"	8.13	9.13	"
21.47	26.37	"	5.36	5.63	"
28.18	36.54	"+2.1.7	1.70	1.42	"

2.1.7 = $2Th(C_2O_4)_2.(NH_4)_2C_2O_4.7H_2O$, 2.1.2 = $2Th(C_2O_4)_2.(NH_4)_2C_2O_4.2H_2O$.

100 gms. 95% formic acid dissolve 0.2 gms. $(NH_4)_2C_2O_4$ at 21°. (Aschan, 1913.)

100 cc. anhydrous hydrazine dissolve 44 gms. $(NH_4)_2C_2O_4$ at room temp. with evolution of ammonia. (Welsh and Broderson, 1915.)

AMMONIUM PALMITATE $C_{16}H_{31}O_2NH_4$.

SOLUBILITY IN SEVERAL SOLVENTS.

(Falciola 1910.)

t°.	Gms $C_{16}H_{31}O_2NH_4$ per 100 cc of: Absolute Alcohol	75% Alcohol	50% Alcohol	Mixture of 1 Pt Alcohol + 2 Parts Ether	Acetone.
0	0.5	...	...	....	...
10	0.7	1.78	...	0.37 (13°)	0.2 (13°)
20	1.4	4.33	5.33	0.29	...
30	...	11.02	...	...	...
40	4.5	14.84	6.69	...	...
50	11	...	...	...	...

AMMONIUM PHOSPHATES $(NH_4)_3PO_4$, $(NH_4)_2HPO_4$, and $NH_4H_2PO_4$.

100 gms. H_2O dissolve 131 gms. $(NH_4)_2HPO_4$ at 15°, d_{15} sat. sol. = 1.343.

(Greenish and Smith, 1901.)

Data for the solubility of mono ammonium phosphate in anhydrous and in aqueous ortho phosphoric acid, determined by the synthetic method, are given by Parravano and Mieli, 1908.

SOLUBILITY OF AMMONIUM PHOSPHATES IN AQUEOUS SOLUTIONS OF ORTHO PHOSPHORIC ACID AT 25°.

(Parker, 1914.)

Gms per 100 Gms. Sat. Solution H_3PO_4	NH_3	Solid Phase	Gms per 100 Gms. Sat. Solution H_3PO_4	NH_3	Solid Phase
4.1	22.6	$(NH_4)_3PO_4.3H_2O$	40	6	$NH_4H_2PO_4$
4.4	18.4	"	30	5.4	"
10	13.1	"	20.6	4	"
20	7	"	30	3.8	"
30	7.7	"	40	4	"
34.4	10	$(NH_4)_3PO_4.3H_2O+(NH_4)_2HPO_4$	50	4.2	"
40	10.2	$(NH_4)_2HPO_4$	60.6	4.4	"
48.2	11.6	$(NH_4)_2HPO_4+NH_4H_2PO_4$			

The original figures have been calculated to grams, plotted on cross-section paper and the above table read from the curve.

Data for this system are also given by D'Ans and Schreiner (1910). The agreement is satisfactory except for the $(NH_4)_3PO_4.3H_2O$ end of the curve, for which much lower values for the NH_3 component are given by D'Ans and Schreiner.

AMMONIUM Magnesium **PHOSPHATE** $NH_4MgPO_4.6H_2O$ and $1H_2O$

SOLUBILITY IN WATER AND SALT SOLUTIONS.

(Bube, 1910.)

The solutions were saturated in 7-16 liter flasks. The stirrer was introduced through a mercury sealed connection, in order to prevent loss of moisture or ammonia during the long periods required for saturation. Great care was exercised to eliminate errors of manipulation. Large volumes of the saturated solutions were used for analysis. In the cases where equilibrium was approached from above (designated by *, in table below) the mixtures were heated to about 90° for ½ hour, and then cooled while being continually stirred for 4.5 hours at 50°, and then in a thermostat at 25° for the remaining period shown.

Solvent	t°	Time for Saturation	Gms per 100 Gms. Sat. Sol. Mg	P_2O_5	NH_3	Solid Phase
Water	25°	69 hrs	0.0808	0.0965		Mixed Hydrates
"	25	9 days	0.0867	0.0992		"
"	25	14 "	0.1352	0.1333	0.1301	"
"	22.7	17 hrs *	0.1076	0.1084	0.1040	Monohydrate
2 n NH_4Cl	25	20 days	0.3129	0.3057		Mixed Hydrates
$\frac{1}{3.2}$ n NH_4Cl+1 n NH_3	25.2	16 hrs *	0.0249	0.02025		Monohydrate
0.2 Mol. $MgCl_2$ per liter H_2O	25	27 days		0.0206	.	Mixed Hydrates
0.2 " " " "	25.2	16 hrs *		0.0512	.	Monohydrate
$\frac{1}{3.2}$ Mol. $(NH_4)_2HPO_4$ per liter H_2O	24.25	*	0.1229			"

SOLUBILITY OF AMMONIUM MAGNESIUM PHOSPHATE IN SEVERAL SOLVENTS.

(Wenner, 1911.)

t°	Gms NH_4MgPO_4 per 100 Gms. Solvent in: Water	Aq. 5% NH_4NO_3	Aq. 5% NH_4Cl	Mixture of 1 Pt. NH_3 (d = 0.96) + 4 Pts. H_2O	Aq. 5% NH_4Cl + 4 NH_3 per 100	Aq. 10% NH_4Cl + 4 NH_3 per 100
0	0.023	0.110	0.060	0.0087	. .	
20	0.052	0.046	0.105	0.0098	0.0165	0.0541
30	...	0.054	0.113	.	...	. .
40	0.036	0.064	0.071	0.0136	...	...
50	0.030	0.072	0.093	0.0153	...	...
60	0.040	0.085	0.173	0.0174	0.0274	0.0731
70	0.016	0.083	0.124	0.0178	...	...
80	0.019	0.101	0.191	0.0145	...	...

AMMONIUM Manganese **PHOSPHATE** $NH_4MnPO_4.7H_2O$.

SOLUBILITY IN SEVERAL SOLVENTS.
(Wenger, 1911.)

t°	Gms NH_4MnPO_4 per 100 Gms Solvent in: Water	Aq 5% NH_4NO_3.	Aq 5% NH_4Cl	Mixture of 1 Pt. NH_3 (d=0.96) + 4 parts H_2O
0	...	0.021	0.002	0.0116
20	0	0.020	0.025	0.0122
30	...	0.023	0.034	...
40	0	0.021	0.039	0.0118
50	...	0.023	0.035	0.0132
60	0	0.027	0.038	0.0194
70	0.005	0.028	0.041	0.0191
80	0.007	0.033	0.045	0.0197

AMMONIUM Sodium **PHOSPHATES**

Data for the distribution of each of 5 ammonium sodium ortho- and pyrophosphates between water and chloroform at 18°, are given by Abbott and Bray (1909).

AMMONIUM Hydrogen **PHOSPHITE** $(NH_4H)HPO_3$.

100 grams water dissolve 171 grams $(NH_4H)HPO_3$ at 0°, 190 grams at 14.5° and 260 grams at 31°. (Amat, 1887.)

AMMONIUM Hypo **PHOSPHITE** $NH_4H_2PO_2$.

100 cc. H_2O dissolve 83 gms. $NH_4H_2PO_2$ at room temp. (Squire and Caines, 1905.)

AMMONIUM PERMANGANATE NH_4MnO_4.

100 parts water dissolve approximately 8 parts of NH_4MnO_4 at 15°. (Aschoff.)

AMMONIUM PICRATE $C_6H_2(NO_2)_3ONH_4$.

100 cc. H_2O dissolve 1.1 gm. Am. picrate at room temp. (Squire and Caines, 1905.)
100 cc. 90% alcohol dissolve 1.2 gm. Am. picrate at room temp. (Squire and Caines, 1905.)

AMMONIUM Fluo **SILICATE** $(NH_4)_2SiF_6$.

100 parts water dissolve 18.5 parts $(NH_4)_2SiF_6$ at 17.5,° Sp. Gr. 1.096. (Stolba, 1877.)

AMMONIUM SALICYLATE $C_6H_4.OH.COONH_4$.

SOLUBILITY IN AQUEOUS ALCOHOL SOLUTIONS AT 25°.
(Seidell, 1909, 1910.)

Gms C_2H_5OH per 100 Gms Solvent	Sp Gr of Sat Sol	Gms C_6H_4 OHCOONH$_4$ per 100 Gms Sat Sol	Gms C_2H_5OH per 100 Gms Sat Sol	Sp Gr of Sat Sol	Gms C_6H_4OH COONH$_4$ per 100 Gms Sat Sol
0	1.148	50.8	70	1.015	42.
20	1.122	50.3	80	0.979	38
40	1.088	48.3	90	0.936	31.6
50	1.067	46.7	95	0.907	27.8
60	1.042	44.7	100	0.875	22.3

AMMONIUM SELENATE $(NH_4)_2SeO_4$

100 gms. H_2O dissolve 1.22 gms. $(NH_4)_2SeO_4$ at 12°. (Tutton, 1907)

AMMONIUM STEARATE $C_{18}H_{35}O_2NH_4$.

SOLUBILITY IN SEVERAL SOLVENTS.
(Falciola, 1910.)

t°.	Gms $C_{18}H_{35}O_2NH_4$ per 100 cc. of Absolute Alcohol	75% Alcohol	50% Alcohol	Ether	Acetone
0	0.1	...	...	...	
10	0.3	0.56	0.25	..	0.08 (13°)
20	0.5	...	0.51	0.1	
30	0.9	1.83	1.10	...	..
40	1.8	5	3.21	...	..
50	5.5	...	...	...	...

AMMONIUM SULFATE $(NH_4)_2SO_4$.

SOLUBILITY IN WATER.
(Mulder.)

t°	Grams $(NH_4)_2SO_4$ per 100 Grams Water	Grams $(NH_4)_2SO_4$ per 100 Grams Solution	t°	Grams $(NH_4)_2SO_4$ per 100 Grams Water	Grams $(NH_4)_2SO_4$ per 100 Grams Solution
0	70.6	41.4	30	78.0	43.8
5	71.8	41.8	40	81.0	44.8
10	73.0	42.2	60	88.0	46.8
15	74.2	42.6	80	95.3	48.8
20	75.4	43.0	100	103.3	50.8
25	76.7	43.4	108.9	107.5	51.8

Sp. Gr. of saturated solution at 15° = 1.248; at 19° = 1.241.

Eutectic point, Ice + $(NH_4)_2SO_4$ = −19.05° and 38.4 gms. $(NH_4)_2SO_4$ per 100 gms. sat. solution.

SOLUBILITY IN AQUEOUS AMMONIA SOLUTIONS AT 25°.
(D'Ans and Schreiner, 1910.)

Mols. per 1000 Gms. Sat. Sol. (NH_3)	Mols. per 1000 Gms. Sat. Sol. $(NH_4)_2SO_4$	Gms. per 1000 Gms. Sat. Sol. (NH_3)	Gms. per 1000 Gms. Sat. Sol. $(NH_4)_2SO_4$
0	3.28	0	433.4
1.02	2.60	17.4	343.6
1.95	2.13	33.2	281.5
3.44	1.59	58.6	210.1
5.35	1.16	91.1	153.3
7.13	0.78	121.4	103
9.47	0	161.2	0

SOLUBILITY OF AMMONIUM SULFATE IN AQUEOUS SOLUTIONS OF COPPER SULFATE AT 30° AND VICE VERSA.
(Schreinemakers, 1910.)

Gms. per 100 Gms. Sat. Solution $(NH_4)_2SO_4$	Gms. per 100 Gms. Sat. Solution $CuSO_4$	Solid Phase	Gms. per 100 Gms. Sat. Solution $(NH_4)_2SO_4$	Gms. per 100 Gms. Sat. Solution $CuSO_4$	Solid Phase
44	0	$(NH_4)_2SO_4$	8.19	13.65	1.1.6
38.32	0.77	$(NH_4)_2SO_4$+1.1.6	6.98	16.77	"
29.27	1.57	1.1.6	5.79	20.53	1.1.6+$CuSO_4.5H_2O$
17.53	4.05	"	2.45	20.19	$CuSO_4.5H_2O$
*9.33	11.03	"	0	20.32	"

* = Solubility of 1.1.6 in water.

1.1.6 = $CuSO_4(NH_4)_2SO_4.6H_2O$.

Several additional determinations for the above system at 19°, are given by Rudorff (1873), and by Schiff (1859).

SOLUBILITY OF AMMONIUM SULFATE IN AQUEOUS SOLUTIONS OF FERROUS SULFATE AT 30° AND VICE VERSA.

(Schreinemakers, 1910 a.)

Gms per 100 Gms Sat Solution $(NH_4)_2SO_4$	Gms per 100 Gms Sat Solution $FeSO_4$	Solid Phase	Gms per 100 Gms Sat Solution $(NH_4)_2SO_4$	Gms per 100 Gms Sat Solution $FeSO_4$	Solid Phase
44.27	0	$(NH_4)_2SO_4$	8.90	17.64	1.1.6
43.88	0.79	$(NH_4)_2SO_4$ + 1.1.6	6.44	23.50	"
34.24	1.72	1.1.6	5.91	25.24	1.1.6 + $FeSO_4.7H_2O$
19.64	5.70	"	5.24	25.24	$FeSO_4.7H_2O$
16.29	7.95	"	0	24.90	"
11.45	13.13	"			

1.1.6 = $(NH_4)_2SO_4.FeSO_4.6H_2O$.

Data for the quaternary system $(NH_4)_2SO_4 + FeSO_4 + Li_2SO_4 + H_2O$ at 30° are also given.

SOLUBILITY OF AMMONIUM SULFATE IN AQUEOUS SOLUTIONS OF LITHIUM SULFATE AND VICE VERSA

(Schreinemakers, Cocheret, Filippo and de Waal, 1905, 1907.)

Results at 30°. Gms per 100 Gms Sat Solution $(NH_4)_2SO_4$	Li_2SO_4	Solid Phase	Results at 50°. Gms per 100 Gms Sat Solution $(NH_4)_2SO_4$	Li_2SO_4	Solid Phase
44.1	0	$(NH_4)_2SO_4$	45.7	0	$(NH_4)_2SO_4$
40.8	3		43.05	5.86	$(NH_4)_2SO_4 + NH_4LiSO_4$
39.5	6.6	$(NH_4)_2SO_4 + NH_4LiSO_4$	19.65	16.35	NH_4LiSO_4
30.	10	NH_4LiSO_4	13.90	21.20	"
21.6	15	"	13.97	21.23	$NH_4LiSO_4 + Li_2SO_4.H_2O$
15	20	"	11.45	21.75	$Li_2SO_4.H_2O$
12.5	21.9	$NH_4LiSO_4 + Li_2SO_4.H_2O$	9.63	22.79	"
8.9	23	$Li_2SO_4.H_2O$	8.58	23.09	"
0	25.1	"	7.56	22.86	"
			0	24.3	"

Additional data for the triple points of the above system at 20°, 57° and 97° are given by Spielrein (1913), but the terms in which the results are presented are not clearly shown.

Data for the quaternary system, ammonium sulfate, lithium sulfate, alcohol and water at 6.5°, 30° and 50° are given by Schreinemakers and van Dorp (1907).

A mixture of an excess of ammonium and of potassium sulfates in water at 19° was found by Rudorff (1873) to contain 37.97 gms. $(NH_4)_2SO_4$ + 39.3 gms. K_2SO_4 per 100 gms. sat. solution.

SOLUBILITY OF AMMONIUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 30°.

(Van Dorp, 1910 and 1911.)

Gms per 100 Gms Sat Solution $(NH_4)_2SO_4$	Gms per 100 Gms Sat Solution H_2SO_4	Solid Phase	Gms per 100 Gms Sat Solution $(NH_4)_2SO_4$	Gms per 100 Gms Sat Solution H_2SO_4	Solid Phase
44.3	0	$(NH_4)_2SO_4$	32.8	40	$(NH_4)HSO_4$
43.6	10	"	26.1	45	"
44.1	13.2	$(NH_4)_2SO_4$ + 3.1	20.9	50	"
42.9	15	3.1	17.6	55	"
41	20	"	17.8	60	"
40.8	25	"	20	61.7	"
43	30	"	30	62.9	"
45.5	33.8	3.1 + $(NH_4)HSO_4$	37	62.2	"
42.3	35	$(NH_4)HSO_4$			

3.1 = $3[(NH_4)_2SO_4].H_2SO_4$.

Data for the solubility of ammonium sulfate in aqueous solutions of sulfuric acid of concentration extending to 10 gm. mols. per liter, are given by D'Ans (1909 and 1913).

Data for the solubility of ammonium and lithium sulfates in concentrated sulfuric acid containing traces of water, at 30°, are given by Van Dorp (1913-14).

Solubility of Ammonium Sulfate in Aqueous Solution of Ethyl Alcohol at 30° and at 50°

(Results at 30° Wibaut 1909, at 50°, Schreinemakers and de Baat, 1907.)

Results at 30°. Two liquid layers are formed at concentrations of alcohol between 5.8 and 62%. These have the compositions

Upper Layer. Gms. per 100 Gms. Sat. Solution			Lower Layer. Gms. per 100 Gms. Sat. Solution		
$(NH_4)_2SO_4$	C_2H_5OH	H_2O	$(NH_4)_2SO_4$	C_2H_5OH	H_2O
2.2	56.6	41.2	37.1	5.8	57.1
2.6	54.5	42.9	35.7	6.3	58
3.4	52.3	44.3	33.8	7.4	58.8
13.2	31.8	55	21.7	18.4	59.9
17	25	58	17	25	58

At a concentration of 62% alcohol the liquid is homogeneous and contains 1.3 gms. $(NH_4)_2SO_4$ per 100 gms. sat. solution. At 90.4% alcohol no $(NH_4)_2SO_4$ is dissolved.

Results at 50°.

Gms. per 100 Gms. Saturated Solution		
$(NH_4)_2SO_4$	C_2H_5OH	H_2O
43.02	2.32	54.66
41.1	4.1	54.8
1.2	64.5	34.3
0.2	75.5	24.3

Between the concentrations 4.1 and 64.5% C_2H_5OH the mixtures separate into two layers. The percentage composition of each member of several such conjoined layers, is as follows.

Upper Layer. Gms. per 100 Gms. Sat. Solution			Lower Layer. Gms. per 100 Gms. Sat. Solution		
$(NH_4)_2SO_4$	C_2H_5OH	H_2O	$(NH_4)_2SO_4$	C_2H_5OH	H_2O
1.2	64.5	34.3	41.1	4.1	54.8
1.6	60	38.4	36.8	6	57.2
3.8	50	46.2	30.8	9	60.2
7.4	40	52.6	26.6	12	61.4
10	34.4	55.6	23.6	15	61.4

Two determinations at 0° by deWaal (1910) gave 30 gms. $(NH_4)_2SO_4$ per 100 gms. sat. solution in 9.41% alcohol and 0.14 gm. $(NH_4)_2SO_4$ in 73.03% alcohol. Between these concentrations of alcohol two liquid layers are formed.

100 gms. 95% formic acid dissolve 25.4 gms. $(NH_4)_2SO_4$ at 16.5°.

(Aschan, 1913.)

SOLUBILITY OF AMMONIUM SULFATE IN AQUEOUS ETHYL ALCOHOL SOLUTIONS.
(*Continued.*)

(Traube and Neuberg — Z. physik. Chem. **1**, 510, '87; Bodlander — *Ibid.* **7**, 318, '91; Schreinemaker — *Ibid.* **23**, 657, '97; de Bruyn — *Ibid.* **32**, 68, '00; Linebarger — Am. Ch. J. **14**, 380, '92.)

Upper Layer Results, Grams per 100 Gms. Solution at 10°–40°: C_2H_5OH	Upper Layer: $(NH_4)_2SO_4$	Lower Layer Results: Gms. C_2H_5OH per 100 Gms. Solution	Lower Layer: Gms. $(NH_4)_2SO_4$ per 100 g. Solution at 6.5°	15°	33°
100	0.0	0	42.0	42.6	44
80	0.1	2.5	39.0	40.2	?
70	0.3	5.0	36.2	37.2	?
60	1.4	7.5	33.2	34.5	42
50	3.2	10.0	30.0	31.0	35
45	4.8	12.5	27.2	28.0	?
40	6.6	15.0	24.6	25.2	?
35	9.2	17.5	22.0	22.4	?
30	12.2	20.0	20.0	20.0	?
25	14.6				

NOTE. — When ammonium sulfate is added to aqueous solutions of alcohol, it is found that for certain concentrations and temperatures the solutions separate into two liquid layers, the upper of which contains the larger percentage of alcohol.

Most of the determinations which have been made upon this system, as contained in the papers referred to above, are given in terms of grams of ammonium sulfate, of alcohol and of water per 100 grams of these three components taken together. Those results which are given in other terms can be readily calculated to this basis, and it is, therefore, possible to make a comparison of the several sets of determinations by plotting on cross-section paper and drawing curves through the points. In the present case the grams of alcohol per 100 grams of solution were taken as ordinates, and the grams of ammonium sulfate in the same quantity of each solution taken as abscissæ. It was found that a single curve could be drawn through practically all the points representing the upper layer solutions at the several temperatures, but the points for the solutions containing the larger amounts of water gave curves which diverged with increase of temperature. The results given for 33° in the above table are not to be accepted as correct until further work has been done.

SOLUBILITY OF AMMONIUM SULFATE IN AQUEOUS PROPYL ALCOHOL SOLUTIONS AT 20°.

(Linebarger — Am. Ch. J. **14**, 380, '92.)

Gms. per 100 Gms. Solution: C_3H_7OH	$(NH_4)_2SO_4$	Gms. per 100 Gms. Solution: C_3H_7OH	$(NH_4)_2SO_4$
70	0.4	40	3.2
60	1.0	30	4.8
50	2.0	20	6.7

AMMONIUM Cadmium **SULFATE** $(NH_4)_2Cd(SO_4)_2.6H_2O$.

100 cc. H_2O dissolve 72.3 gms. $(NH_4)_2Cd(SO_4)_2$ at 25°. (Locke, 1901.)

AMMONIUM Chromium **SULFATE** (Alum) $(NH_4)_2Cr_2(SO_4)_4.24H_2O$.

100 cc. H_2O dissolve 10.78 gms. anhydrous or 21.21 gms. hydrated salt at 25°. (Locke, 1901.)

AMMONIUM Cobalt **SULFATE** $(NH_4)_2Co(SO_4)_2.6H_2O$.

SOLUBILITY IN WATER.

(Tobler — Liebig's Annalen 95, 193, '55; v. Hauer — J. pr. Chem. 74, 433, '58, at 25°, Locke — Am. Ch. J. 27, 459, '01.)

t°.	Gms. $(NH_4)_2Co(SO_4)_2$ per 100 Gms. Water	Solution.	t°.	Gms. $(NH_4)_2Co(SO_4)_2$ per 100 Gms. Water	Solution.
0	6.0	5.7	40	22.0	18.0
10	9.5	8.7	50	27.0	21.3
20	13.0	11.5	60	33.5	25.1
25	14.72	12.8	70	40.0	28.6
30	17.0	14.5	80	49.0	32.9

NOTE. — The determinations reported by the above named investigators were plotted on cross-section paper and although considerable variations were noted, an average curve which probably represents very nearly the true conditions was drawn through them, and the above table made from this curve.

AMMONIUM Indium **SULFATE** $(NH_4)_2In_2(SO_4)_4.24H_2O$.

100 gms. H_2O dissolve 200 gms. salt at 16° and 400 gms. at 30°. (Rossler, 1873.)

AMMONIUM Iron **SULFATE** (Alum) $(NH_4)_2Fe_2(SO_4)_4.24H_2O$.

100 cc. H_2O dissolve 44.15 gms. anhydrous or 124.40 gms. hydrated salt at 25°. Sp. gr. of saturated solution at 15° = 1.203. (Locke, 1901.)

AMMONIUM Iron **SULFATE** (ferrous) $(NH_4)_2Fe(SO_4)_2.6H_2O$.

SOLUBILITY IN WATER.

(Tobler, at 25°, Locke — Am. Ch. J. 27, 459, '01.)

t°.	G. $(NH_4)_2Fe(SO_4)_2$ per 100 g. H_2O.	t°.	G. $(NH_4)_2Fe(SO_4)_2$ per 100 g. H_2O.	t°.	G. $(NH_4)_2Fe(SO_4)_2$ per 100 g. H_2O.
0	12.5	25	25.0 (T)	50	40
15	20.0	25	35.1 (L)	70	52
		40	33.0		

AMMONIUM Lead **SULFATE** $(NH_4)_2SO_4.PbSO_4$.

SOLUBILITY IN WATER.

(Barre, 1909.)

t°	Gms. $(NH_4)_2SO_4$ per 100 Gms. Sat. Solution.	Water.	Solid Phase.
20	12.17	13.86	$(NH_4)_2SO_4.PbSO_4$
50	16.15	19.25	"
75	19.52	24.31	"
100	22.74	29.42	"

AMMONIUM Lithium **SULFATE** NH_4LiSO_4.

SOLUBILITY IN WATER.

(Schreinemakers, Cocheret, Filippo and de Waal, 1905, 1907.)

t°.	Gms. NH_4LiSO_4 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. NH_4LiSO_4 per 100 Gms. Sat. Sol.	Solid Phase.
0	0	Ice	−10	35.25	NH_4LiSO_4
−5	14	"	+10	35.58	"
−10	23.5	"	30	35.87	"
−15	29.7	"	50	36	"
−20.6 Eutec.	35.15	Ice+NH_4LiSO_4	70	36.18	"

AMMONIUM Magnesium **SULFATE** $(NH_4)_2Mg(SO_4)_2$.

SOLUBILITY OF AMMONIUM MAGNESIUM SULFATE IN WATER.

(Porlezza, 1914.)

t°.	Gms. per 100 Gms. Sat. Sol.	Gms. per 100 Gms. Water.	Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol.	Gms. per 100 Gms. Water.	Solid Phase.
−0.34	1.01	1.02	Ice	20	15.23	17.96	$(NH_4)_2Mg(SO_4)_2$
−0.80	2.98	3.07	"	25	16.45	19.69	"
−1.23	4.92	5.17	"	30	17.84	21.71	"
−1.60	6.56	7.02	"	40	20.51	25.86	"
−2.02	8.34	9.10	"	50	23.18	30.17	"
−2.34 Eutec.			Ice+$(NH_4)_2Mg(SO_4)_2$	60	26.02	35.17	"
0	10.58	11.83	$(NH_4)_2MgSO_4$	80	32.58	48.32	"
10	12.75	14.61	"	100	39.66	65.72	"

AMMONIUM Manganese **SULFATE** $(NH_4)_2Mn(SO_4)_2.6H_2O$.

100 cc. water dissolve 37.2 gms. $(NH_4)_2Mn(SO_4)_2$ at 25°. (Locke, 1901.)

AMMONIUM Nickel **SULFATE** $(NH_4)_2Ni(SO_4)_2.6H_2O$.

SOLUBILITY IN WATER.

(Average curve from Tobler, Locke, at 25°.)

t°.	G. $(NH_4)_2Ni(SO_4)_2$ per 100 Gms. Water.	G. $(NH_4)_2Ni(SO_4)_2$ per 100 Gms. Solution.	t°.	G. $(NH_4)_2Ni(SO_4)_2$ per 100 Gms. Water.	G. $(NH_4)_2Ni(SO_4)_2$ per 100 Gms. Solution.
0	1.0	0.99	40	12.0	10.72
10	4.0	3.85	50	14.5	12.96
20	6.5	6.10	60	17.0	14.53
25	7.57	7.04	70	20.0	16.66
30	9.0	8.45			

AMMONIUM Sodium **SULFATE** $NH_4NaSO_4.2H_2O$.

100 gms. water dissolve 46.6 gms. $NH_4NaSO_4.2H_2O$ at 15° Sp. Gr., of Sol. = 1.1749.

AMMONIUM Strontium **SULFATE** $(NH_4)_2SO_4.SrSO_4$.

SOLUBILITY IN WATER.

(Barre, 1909.)

t°.	Gms. $(NH_4)_2SO_4$ per 100 Gms. Sat. Solution.	Gms. $(NH_4)_2SO_4$ per 100 Gms. Water.	Solid Phase.
50	43.99	78.54	$(NH_4)_2SO_4.SrSO_4$+$SrSO_4$
75	45.40	83.15	"
100	46.27	66.2	

AMMONIUM Vanadium **SULFATE** (Alum) $(NH_4)_2V_2(SO_4)_4 24H_2O$.

100 cc. H_2O dissolve 31.69 gms. anhydrous or 78.50 gms. hydrated salt at 25°. (Locke.)

AMMONIUM Zinc **SULFATE** $(NH_4)_2Zn(SO_4)_2.6H_2O$.

SOLUBILITY IN WATER.

(Average curve, see Note, p. 67, Tobler, Locke, at 25°.)

t°.	G. $(NH_4)_2Zn(SO_4)_2$ per 100 Gms. Solution.	Water.	t°.	G. $(NH_4)_2Zn(SO_4)_2$ per 100 Gms. Solution.	Water.
0	6.54	7.0	40	16.66	20
10	8.67	9.5	50	20.0	25
20	11.11	12.5	60	23.1	30
25	12.36	14.1	70	25.9	35
30	13.79	16.0	80	29.6	42

AMMONIUM PERSULFATE $(NH_4)_2S_2O_8$.

100 parts H_2O dissolve 58.2 parts $(NH_4)_2S_2O_8$ at 0°. (Marshall, 1891.)

AMMONIUM Sodium Hydrogen **SULFITE** $(NH_4)Na_2H(SO_3)_2.4H_2O$.

100 gms. H_2O dissolve 42.3 gms. salt at 12.4° and 48.5° gms. at 15°. (Schwicker, 1889.)

AMMONIUM Antimony **SULFIDE** (Sulfoantimonate) $(NH_4)_3SbS_4.4H_2O$.

SOLUBILITY IN WATER AND IN AQUEOUS ALCOHOL.

(Donk, 1908.)

In Water			In Aqueous Alcohol at 10°.	
t°.	Gms. $(NH_4)_3SbS_4$ per 100 Gms. Sat. Sol.	Solid Phase.	Gms. per 100 Gms. Sat. Solution. C_2H_5OH	$(NH_4)_3SbS_4$
− 1.9	9.9	Ice	0	43.2
− 5	20	"	5.1	35.9
− 8	30.2	"	19.1	23.1
−13.5	41.6	Ice+$(NH_4)_3SbS_4.4H_2O$	43.1	8.7
0	41.6	$(NH_4)_3SbS_4.4H_2O$	53.1	4.1
+20	47.7	"	93.3	0
30	54.5	"		

AMMONIUM β-Naphthalene Mono **SULFONATE** $C_{10}H_7SO_3NH_4$.

100 cc. of the saturated aqueous solution contain 13.05 gms. of the salt at 25°, and d_{25} = 1.034. (Witt, 1915.)

AMMONIUM Phenanthrene Mono **SULFONATES** $C_{14}H_9SO_3NH_4$ (2), (3) and (10).

SOLUBILITY IN WATER AT 20°.

(Sandqvist, 1912.)

100 gms. H_2O dissolve 0.37 gms. $C_{14}H_9SO_3NH_4$ (2)
100 gms. H_2O dissolve 0.26 gms. $C_{14}H_9SO_3NH_4$ (3)
100 gms. H_2O dissolve 4.41 gms. $C_{14}H_9SO_3NH_4$ (10)

AMMONIUM 2.5 di-iodobenzene **SULFONATE** $C_6H_3I_2SO_3(NH_4)$.

100 gms. H_2O dissolve 4.35 gms. salt at 20°. (Boyle, 1909.)

AMMONIUM TARTRATES $(NH_4)_2C_4H_4O_6$.

100 cc. H_2O dissolve 2.83 gms. $(NH_4)_2C_4H_4O_6.2H_2O$ at 0°. (Peaton, 1898.)
100 cc. H_2O dissolve 59 gms. $(NH_4)_2C_4H_4O_6$ at 15° (d = 1.04). (Greenish and Smith, 1903.)

AMMONIUM Lithium **TARTRATES** dextro and racemic.

100 gms. sat. sol. in H_2O contain 13.104 gms. racemate $(NH_4)Li(C_4H_4O_6).H_2O$ at 20°.
100 gms. sat. solution in H_2O contain 14.186 gms. dextro $(NH_4)Li(C_4H_4O_6).\frac{1}{2}H_2O$ at 20°. (Schlossberg, 1900.)

Freezing-point data for mixtures of water and ammonium tartrate and of water and ammonium racemate are given by Bruni and Finzi (1905).

AMMONIUM THIOCYANATE NH_4SCN

SOLUBILITY IN WATER.

(Average curve from results of Rudorff, 1868 and 1872, Wassiljew, 1910, Smits and Kettner, 1912.)

t°	Gms NH_4SCN per 100 Gms Sat Sol	Solid Phase	t°.	Gms NH_4SCN per 100 Gms Sat Sol	Solid Phase
−10	20	Ice	0	54.5	NH_4SCN
−15	28.5	"	+10	59	"
−20	35.5	"	20	63	"
−25.2	42 Eutec.	Ice+NH_4SCN	25	65.5	"
−10	50	NH_4SCN	30	67.5	"

Data for the system ammonium thiocyanate, thiourea and water at 25° are given by Smits and Kettner (1912) in the form of a triangular diagram, but the numerical results are omitted. The diagram confirms the freezing-point lowering results in showing that the molecular compound $NH_4SCN.4(NH_4)_2CS$ is formed.

100 gms. acetonitrile dissolve 7.52 gms NH_4SCN at 18° (Naumann and Schier, 1914.)

Freezing-point curves have been determined for the following mixtures:

Ammonium Thiocyanate + Ammonia. (Bradley and Alexander, 1912.)
" " + Potassium Thiocyanate. (Wrzesnewsky, 1912.)
" " + Thiocarbamide (Thiourea). (Reynolds and Werner, 1903, Findlay, 1904, Atkins and Werner, 1912, Smits and Kettner, 1912, Wrzesnewsky, 1912.)

AMMONIUM URATE (Primary) $C_5H_3N_4O_3NH_4$

SOLUBILITY OF THE LACTAM AND LACTIM FORMS IN WATER.

(Gudzeit, 1908-09.)

t°	Gms of Each per 1000 cc Sat Solution		
	Lactam	Lactim	Mixture of the Two.
18	0.456	0.304	0.414
37	0.817	0.540	0.741

AMMONIUM Meta VANADATE NH_4VO_3

SOLUBILITY IN WATER AND IN AQUEOUS AMMONIUM SALT AND AMMONIUM HYDROXIDE SOLUTIONS.

(Meyer, 1909.)

t°	Gms per 1000 cc in Each Solvent							
	Water	0.05 n NH_4Cl	0.1 n NH_4Cl	0.05 n NH_4NO_3	0.1 n NH_4NO_3	0.0668 n NH_3	0.215 n NH_3	0.588 n NH_3
18	4.35	1.66	0.41	1.67	0.58	5.58	7.97	12.06
25	6.08	2.63	1.17	2.77	1.23	7.06	8.58	12.66
35	10.77	5.21	2.69		...	..	...	...
45	15.71	8.88	5.40	.	...	...	..	...
55	19.97	11.18	7.40	..	...	...	...	...
70	30.47	..	..	..	...	...	...	...

100 cc. anhydrous hydrazine dissolve 2 gms. ammonium metavanadate at room temp. (Welsh and Broderson, 1915.)

AMYGDALIN $C_{20}H_{27}NO_{11}.3H_2O$.

100 gms. trichlorethylene dissolve 0.029 gm. amygdalin at 15°. (Wester and Bruins, 1914.)

AMYL ACETATE BUTYRATE, FORMATE, etc.

SOLUBILITY IN WATER AND IN AQUEOUS ALCOHOL AT 20°.

(Bancroft — Phys. Rev 3, 131, 196, 205, '95-'96, Traube — Ber 17, 2304, '84.)

Ester.	cc Ester per 100 cc. H_2O.	Sp Gr. of Ester.	Ester.	cc Ester per 100 cc H_2O	Sp. Gr. of Ester.
Amyl acetate	0.2	0.88	Amyl propionate	0.1	0.88
Iso amyl acetate	0.2 (1.2?)	...	Iso amyl formate	0.3 (gms. at 22°)	
Amyl butyrate	0.06	0.85			

Solubility in Aqueous Alcohol at Room Temperature.

(Pfeiffer 1892.)

Solubility of Iso Amyl Acetate in Aq. Alcohol Mixtures.

Per 5 cc C_2H_5OH	
cc. H_2O.	cc Iso Amyl acetate.
7	0 41
6	0.7
5	1 31
3 61	3 0
3 01	4 0
2 60	5 0

Solubility of Amyl Acetate and Amyl Formate in Aq. Alcohol Mixtures.

cc C_2H_5OH in Mixture.	cc H_2O added to cause separation of second phase in mixture of the given amounts of alcohol and 5 cc portions of Amyl Formate	Amyl Acetate
3	1 80	1 76
9	8 77	9 03
15	17 01	17 52
21	27 06	26 99
27	38 31	37 23
33	50 71	48 41
39	65 21	...
45	85 10	...
48	94 20	...

AMYL ALCOHOL $C_5H_{11}OH$.

Solubility of Amyl Alcohol in Water at 22°

(Herz — Ber. 31, 2671, '98.)

100 cc water dissolve 3 284 cc. amyl alcohol Sp. Gr. of solution = 0 9949, Volume = 102 99 cc.

100 cc amyl alcohol dissolve 2 214 cc. water Sp Gr. of solution 0 8248, Volume 101 28 cc

Sp. Gr of H_2O at 22° 0 9980, Sp Gr of amyl alcohol at 22° 0 8133

Solubility in Aqueous Solutions of Ethyl Alcohol.

(Pfeiffer, 1892, Pancroft, 1895 96.)

Mixture of $C_5H_{11}OH$ +	C_2H_5OH	cc H_2O added to* Mixture at 9 1°.	19 2°.	Mixture of $C_5H_{11}OH$ +	C_2H_5OH	cc H_2O Added to* Mixture at 13 3°.	17 4°.
cc	cc			cc	cc		
3	3	3.21	3 5	3	3	3 36	3.47
3	6	10.35	10 80	6	3	2.20	2 25
3	9	18.34	19 10	9	3	2.10	2 15
3	12	27.47	29 15	12	3	2.10	2.10
3	15	41 25	43 15	15	3	2.10	2.10

* Just enough water was added to produce cloudiness.

Note. — The effect of various amounts of a large number of salts upon the temperature (39.8°) at which a mixture of 20 cc. of amyl alcohol + 20 cc. of ethyl alcohol + 32 9 cc of water becomes homogeneous has been investigated by Pfeiffer (Z. phys Ch 9, 444, '92) The results are no doubt of interest from a solubility standpoint, but their recalculation to terms suitable for presentation in the present compilation has not been attempted

Distribution of Isoamyl Alcohol between Water and Cotton Seed Oil at 25°.

(Wroth and Reid, 1916.)

Gms $C_5H_{11}OH$ per 100 cc Oil Layer	H_2O Layer	Ratio
1.947	0 9153	0 470
2.195	1.1156	0.508
2.273	1 1050	0 486
2.372	0.9995	0.421

SOLUBILITY OF AMYL ALCOHOL IN WATER AND IN AQUEOUS SOLUTIONS OF ETHYL AND METHYL ALCOHOLS.

(Fontein, 1910.)

In Water.			In Aq. Ethyl Alcohol.*			In Aq. Methyl Alcohol.†		
t°.	Gms $C_5H_{11}OH$ per 100 Gms H_2O Layer	Gms $C_5H_{11}OH$ per 100 Gms $C_5H_{11}OH$ Layer	t°.	Gms $C_5H_{11}OH$ per 100 Gms $C_2H_5OH+H_2O$ Layer	Gms $C_5H_{11}OH$ per 100 Gms $C_5H_{11}OH$ Layer	t°.	Gms $C_5H_{11}OH$ per 100 Gms CH_3OH+H_2O Layer	Gms $C_5H_{11}OH$ per 100 Gms $C_5H_{11}OH$ Layer
0.5	4	...	4.5	16.2	...	3.6	11	...
15.5	2.6	90.7	20	20.8	...	20	19.3	...
20	2.6	90.6	40	26.7	...	38.4	...	78.4
40	2.1	89.5	60	33	...	40	31.2	78
60	2	88	67.8	...	24.4	50	37.1	74.8
80	2.5	86	70	36.5	73.7	60	43.3	71.6
100	3	83.8	80	40.8	70.1	70	52.7	65
120	3.8	80.8	90	47	64	72	(crit. temp.)	
140	5	76.4	94.2	(crit. temp.)				
160	7.3	70						
170	9.3	65.1						
180	13.5	57.3						
187.5	(crit. temp.)							

* Of 33.55 per cent C_2H_5OH † Of 33 per cent CH_3OH

The "synthetic method" was used for the preceding determinations. Fermentation amyl alcohol of b. pt. 131°–131.4° and d_{15} = 0.814 was employed. It contained 16% of optically active amyl alcohol. Many other series of determinations were made with solvents containing other percentages of ethyl and methyl alcohol. Also, other series were made for the above-named ternary systems at constant temperatures from which binodal curves were obtained. The author uses a very ingenious indirect method for determining the composition of the conjugated solutions. Data are also given for the distribution of ethyl alcohol between water and amyl alcohol.

The results of Alexejew (1886) for the solubility of amyl alcohol in water agree fairly well with the above data.

AMYL AMINE $C_5H_{11}.NH_2$.

The freezing-point curve for mixtures of amyl amine and water is given by Pickering (1893).

Iso AMYLAMINE HYDROCHLORIDE $C_5H_{11}.NH_2.HCl$ (iso).

100 gms. H_2O dissolve 192.2 gms. of the salt at 25°. (Peddle and Turner, 1913.)
100 gms. $CHCl_3$ dissolve 5.1 gms. of the salt at 25°.

Data for the distribution of ε-chloramyl amine between water and tetrachlorethane at 0°, water and nitrobenzene at 25° and water and benzene at 25° are given by Freundlich and Richards (1912).

AMYLENE (Trimethylethylene) $(CH_3)_2C:CHCH_3$.

RECIPROCAL SOLUBILITY IN ANILINE; DETERMINATIONS BY SYNTHETIC METHOD.

(Konowalow, 1903.)

t°.	Gms Aniline per 100 Gms Amylene Layer	Gms Aniline per 100 Gms Aniline Layer	t°.	Gms Aniline per 100 Gms Amylene Layer	Gms Aniline per 100 Gms Aniline Layer
0	19.5	81.5	10	28	73
2	19.7	80.5	12	34	68
4	20.5	79.5	13	38.5	64.7
6	21.7	78	14	45	59
8	24.2	75.8	14.5 (crit. temp.)	51.6	

SOLUBILITY OF AMYLENE IN LIQUID CARBON DIOXIDE.
(Buchner, 1905, 06)
(Determinations made by the synthetic method)

t°. (crit.)	31	103	201
Gms. C_5H_{10} per 100 gms. sat. sol.	0	38	100

AMYLENE HYDRATE $(CH_3)_2C(OH)CH_2.CH_3$.

The distribution coefficient of amylene hydrate between olive oil and water at ord. temp. is 1. (Baum, 1899)

ANDROMEDOTOXINE $C_{31}H_{51}O_{10}$.

SOLUBILITY IN SEVERAL SOLVENTS AT 12° AND AT THE BOILING-POINTS OF THE SOLVENTS.
(Zaayer, 1886)

Solvent	Gms $C_{31}H_{51}O_{10}$ per 100 Gms Sat Sol at 12°	B Pt
Water	2 81	0.87
Ethyl alcohol (d_{12} = 0 821)	11 70	...
Amyl alcohol	1 14	...
Chloroform	0 26	0 26
Commercial ether	0 07	0 07
Benzine	0 004	...

ANETHOLE (*p* Propylanisole) $CH_3CHCH[4]C_6H_4OCH_3$.

SOLUBILITY IN AQUEOUS ALCOHOL AT 20°
(Schimmel and Co, Report, Oct 1895, p 6)

Vol. per cent alcohol =	20	25	30	40	50
Gm. anethole per liter aq. alcohol =	0 12	0 20	0 32	0 86	2 30

333 3 gms. anethole dissolve in one liter of 90% alcohol at room temperature (Squire and Caines, 1905)

Freezing-point data for mixtures of anethole and menthol are given by Scheuer (1910).

ANILINE $C_6H_5(NH_2)$.

SOLUBILITY IN WATER AT 22°.
(Herz, 1898, see also Vaubel, 1895, Aignan and Dugas, 1899)

100 cc. H_2O dissolve 3 481 cc $C_6H_5(NH_2)$ — Vol of Sol. = 103 48, Sp Gr. = 0 9986

100 cc. $C_6H_5(NH_2)$ dissolve 5 22 cc H_2O — Vol. of Sol. = 104 96, Sp. Gr. = 1.0175.

100 cc. sat. aq. sol. contain 3 607 gms. $C_6H_5NH_2$ at 25°. (Reidel, 1906)

SOLUBILITY OF ANILINE IN WATER. (Determination by synthetic method)
(Sidgwick, Pickford and Wilsdon, 1911)

t°.	Gms $C_6H_5NH_2$ per 100 Gms Aq Layer	Aniline Layer	t°.	Gms $C_6H_5NH_2$ per 100 Gms Aq Layer	Aniline Layer
13.8	3 611	5 12 (20°)	120	9.1	14 6
30	3 7	5 4	130	11.2	16 9
50	4.2	6.4	140	13.5	19 5
70	5	7.7	150	17.1	24
90	6 4	9.9	160	22	32
110	8	13	165	26.1	...

The critical solution temperature for aniline and water is 168°.

Alexejew (1886) and Rothmund (1898) obtained results for the preceding system which differ in part quite widely from the above table.

More recent determinations, in terms of cc. aniline per 100 cc. of mixture, are given by Kolthoff (1917).

Solubility of Aniline in Aqueous Solutions of Aniline Hydrochloride.

(Sidgwick, Pickford and Wilsdon, 1911)

The temperatures at which a second liquid phase separated from homogeneous mixtures of known amounts of aniline + HCl + H_2O were determined for a very extensive series of mixtures. The procedure consisted in first heating a given mixture until it became homogeneous and then cooling it slowly, with constant shaking. A critical turbidity preceding the actual separation by a few degrees was always noticed. The point of separation was taken as that at which a small gas flame seen through the liquid disappeared. At higher temperatures, the observations were made on mixtures contained in sealed bulbs. In the actual experiments, binodal curves for mixtures of Aq. HCl (of different strengths) and aniline were determined. By interpolation from these, the following isothermal curves were obtained.

Isotherm for 15°.				Isotherm for 25°.			
H_2O Rich Mixtures Gms per 100 Gms Sat Solution		Aniline Rich Mixtures Gms per 100 Gms Sat Solution		H_2O Rich Mixtures Gms per 100 Gms Sat Solution		Aniline Rich Mixtures Gms per 100 Gms Sat Solution	
$C_6H_5NH_2$	$C_6H_5NH_2.HCl$	H_2O	$C_6H_5NH_2.HCl$	$C_6H_5NH_2$	$C_6H_5NH_2.HCl$	H_2O	$C_6H_5NH_2.HCl$
3 615	0	7.276	3 025	3.681	0	14	8 884
3 791	1 529	7 231	1 989	4 020	3 02	10 84	6 062
4 144	5 829	5 816	1 195	5 380	11 40	6.949	1 912
4 940	11 44	5 230	0 340	7 023	15 83	6 043	0 828
5.995	16 03	5 006	0 163	11 86	19 02	5 568	0 363
10 44	19 35	4 960	0 080	31.35	20 15	5 311	0 089
26.80	21.49	4 942	0	59 95	15 55	5 299	0
Isotherm for 40°.				Isotherm for 60°.			
3 941	0	15 65	8 752	4 58	0	14 27	5 93
4 187	1 523	10 21	4 243	4 87	1 512	9 569	2 632
4 371	3 009	7.874	2 166	5 13	2 984	8 109	1 112
4 823	5 815	7 069	1 452	5 67	5 762	7 492	0 4876
6.210	11.30	7 058	0 9669	7 69	11 14	7 051	0 2284
8.779	15.55	6 225	0.4052	11 53	15.25	7.047	0 1138
38.69	18	5 940	0.0960	22.80	16 66	7 030	0
64.20	12 84	5 930	0	51.10	14 36		
Isotherm for 80°.				Isotherm for 100°.			
5 66	0	12 31	3 387	7 10	0	41 57	11 45
5 95	1 405	9 848	1.350	7 68	1.467	18 16	4 995
6 26	2 950	8 998	0 5857	8.10	2 891	12 76	1 784
7.11	5 678	8 524	0 2769	9 60	5 522	11.37	0 1836
9 95	10 85	8.512	0.1387	13.60	10.41	11.90	0
31.18	14.85	8.500	0				
Isotherm for 120°.				Isotherm for 140°.			
9.30	0	17.94	2.459	13.75	0	29.52	4.043
21.21	9.497	14.45	0	38.75	7.384	21 09	0

The authors also calculated the position of tie lines for the binodal curves with the aid of distribution coefficients, which they determined at 25° and which are quoted in a subsequent table (page 78 following).

Additional data for the system aniline + HCl + H_2O at 0°, 25° and at 35° are given by Thonus (1913), and for aniline + HCl by Leopold (1910).

Solubility of Aniline in Aqueous Salt Solutions at 18°.

(Euler — Z. physik. Chem. 49, 307, '04.)

Aq. Solution	Gms. Salt per liter.	Gms. $C_6H_5(NH_2)$ per 100 g. solvent.	Aq. Solution	Gms. Salt per liter.	Gms. $C_6H_5(NH_2)$ per 100 g. solvent.
H_2O alone	0	3.61	1 nNaOH	40.06	1.90
0.5 nKCl	37.3	3.15	1 nLiCl	42.48	2.80
1 nKCl	74.6	2.68	1 nCaCl$_2$	67.25	3.00
1 nNaCl	58.5	2.55			

Solubility of Aniline in Aqueous Aniline Hydrochloride Solutions at 18°.

(Lidow — J. russ. phys. chem. Ges. 15, 420, '83; Ber. 16, 2297, '83.)

Per cent $C_6H_5NH_2HCl$ in Solvent.	Gms. $C_6H_5NH_2$ per 100 g. Solvent.	Per cent $C_6H_5NH_2HCl$ in Solvent.	Gms. $C_6H_5NH_2$ per 100 g. Solvent.
5	3.8	30	39.2
12	5.3	35	50.4

Solubility of Aniline in Aqueous Solutions of Glycerol and Vice Versa.

(Kolthoff, 1917.)

(The liquids were measured from burets. The determinations at 100° were made in sealed tubes. The others were made in open tubes.)

Results for the Solubility of Aniline in Aqueous Glycerol.

Per cent Glycerol in Aq. Mixture used.	cc. Aniline dissolved by 100 cc. of Aq. Glycerol of Conc. shown at 18°	25°	36°	100°
0 (= water)	3.25	3.4	5.6	9.9
39	5.15	5.3	...	...
56	7.5	7.6	...	28 (58% Glycerol)
65	10	..	...	38 (66% ")
74.3	11.75	12.1	...	...
78	20	20	16	...
87	70	...	...	...

Results for the Solubility of Aqueous Glycerol in Aniline.

Per cent Glycerol in Aq. Mixture used.	cc. of Aq. Glycerol Mixture dissolved by 100 cc. Aniline at 18°	25°	36°	100°
0 (= water)	4.6	5	4	5.3
39	..	6.4	...	...
47	5.2	..	...	...
56	7.9	7.7	...	15 (58% Glycerol)
74.3	13.1	11.7	...	17 (66% ")
78	17.1	14.8	...	...

Distribution of Aniline between Water and Benzene at 25°.

(Farmer and Warth, 1904.)

Gms. $C_6H_5NH_2$ per 100 cc. Water Layer.	C_6H_6 Layer.	Ratio.
0.0135	0.1312	9.7
0.0122	0.1282	10.5
0.0065	0.0656	10.1

Data for the distribution between water and benzene at 25° of each of the following substituted anilines, o, m and p nitraniline, chloraniline, bromaniline, p nitrosmethylaniline, and p nitrosodimethylaniline are given by Farmer and Warth (1904).

Solubility of Aniline, Phenol Mixtures in Water.

(Schreinemaker — Z. physik. Chem. 29, 584, 30, 460, '99.)

t°.	Mixture used = 25.4 Mols. Aniline + 74.6 Mols Phenol Gms of Mixture per 100 Gms Aq Layer	A + P Layer	t°.	Mixture used = 50 Mols. Aniline + 50 Mols Phenol Gms of Mixture per 100 Gms Aq Layer.	A. + P Layer.
40	5 0	86 0	40	4.0	91 5
60	5 5	82 0	80	5 5	85 5
80	8 0	77 0	100	8 0	82 0
100	12 5	67 0	120	13 5	73 5
110	19 0	56 5	130	19 0	66 0
104 (crit. temp.)	33	...	135	23 5	58 0
			140 (crit. temp.)	35	...

Determinations in above table by "Synthetic Method," see NOTE, p 16. Schreinemakers gives results for several other mixtures of aniline and phenol which yield curves entirely similar to those for the two mixtures here shown.

Distribution of Aniline between:

(Vaubel — J pr. Chem [2] 67, 477, '03)

Water and Ether. Composition of Solutions G $C_6H_5NH_2$ Used	Solvent.	Gms $C_6H_5NH_2$ in: Aq Layer.	Ether Layer.	Water and Carbon Tetrachloride. Composition of Solutions G. $C_6H_5NH_2$ Used	Solvent.	Gms $C_6H_5NH_2$ in. Aq Layer.	CCl_4 Layer.
1.2478	50 cc. H_2O + 20 cc. Ether	0.1671	1.0807	0.3478	50 cc. H_2O + 20 cc. CCl_4	0.3358	0.012
1.2478	50 cc. H_2O + 50 cc. Ether	0.0835	1.1643	1.2478	50 cc. H_2O + 50 cc CCl_4	0.2767	1.971
1.2478	50 cc. H_2O + 100 cc. Ether	0 0594	1.1884	1.2478	50 cc. H_2O + 100 cc. CCl_4	0.1845	1.063

Solubility of Aniline in Sulphur.

(Alexejew — Ann. Physik. Chem. 28, 305, '86)

t°.	Gms $C_6H_5NH_2$ per 100 g. S. Layer	Anilin Layer.	t°.	Gms $C_6H_5NH_2$ per 100 g S Layer.	Anilin Layer
100	4	75	130	15	58
110	6	70	135	17.5	47
120	10	64	138 (crit. temp.)	23	..

Distribution of Aniline between Water and Toluene at 25°.

(Riedel, 1906)

NOTE. — Mixtures of aniline and toluene were shaken with water and after separation of the two layers the Sp. Gr. of the A : T mixture (layer) was determined and also the amount of aniline in each layer.

Solution Shaken with A . T Mixture.	Vol per cent Aniline : Toluene in Mixtures Used.	Sp Gr of A : T Mixture after Separation	Gms $C_6H_5NH_2$ in 100 cc of: A . T Layer	Aq Layer
H_2O	50:50	0.9257	41.5	2 14
"	25:75	0 8928	20.7	1 5
"	12 5:87.5	0 8737	8 62	0 86
"	5 5:94 5	0 8661	3 87	0 45
"	2 5:97.5	0 8627	1.68	0.21

The author also gives data for the distribution of aniline between toluene and aqueous solutions of K_2SO_4, KBO_3, $Ba(OH)_2$, $Sr(OH)_2$ and $Ca(OH)_2$.

SOLUBILITY DATA DETERMINED BY THE FREEZING-POINT METHOD (see footnote, page 1) ARE GIVEN FOR MIXTURES OF ANILINE (m. pt. −5.5° to −6.8°) AND OTHER COMPOUNDS.

Name and M. Pt. of the Other Compound of Each Mixture.	Data for First Eutectic: M. Pt.	Data for First Eutectic: Wt. Per Cent $C_6H_5NH_2$	Authority
Nitrosodimethyl aniline (85.5°)	−9.2	94.2[1]	(Kremann, 1904)
Benzene (5.42°)		.	(Kremann and Borjanovics, 1916)
Nitrosobenzene (63.5°)	−12.5	77.2	(Kremann, 1904)
Nitrobenzene (2.8°)	−30.6	53.4	"
o Dinitrobenzene (116.5°)	−10	92.2	(Kremann and Rodinis, 1906)
m " (91°)	−8	92.7[2]	(Kremann, 1904)
p "	no eutectic		(Kremann and Rodinis, 1906)
s Trinitrobenzene (122.2°)	not determined[3]		(Kremann, 1904)
o Chloronitrobenzene (32°)	−19.5	66.1	(Kremann, 1907)
m " (43°)	−12.6	79.7	(Kremann and Rodinis, 1906)
p " (82.5°	−16.3	72.7	" "
Benzoic acid (121.25°)			(Baskov, 1913)
Chloroform (−63°)	−71	21.7	(Tsakalatos and Guye, 1910)
o Cresol (30.4°)	−17	78.8[4]	(Kremann, 1906)
m " (4.2°)	−30	74.3[5]	"
p " (33.2°)	−15.5	85.5[6]	(Kremann 1906, Philip, 1903)
Ethylacetate (−83.8°)	.		(Wroczynski and Guye 1910)
Hydroquinone	89	62	(Kremann and Rodinis, 1906)
Allyl mustard oil	.		(Kurnakov and Kriat, 1913) (Kurnakov and Solover, 1916)
o Chlorophenol		[7]	(Bramley, 1916)
o Nitrophenol (46°)	−13.5	80.2	(Kremann and Rodinis, 1906)
m " (96°)	−18.7	74.2[8]	" "
p " (113°)	−17.5	86.8[9]	"
m Dinitrophenol (110.5°)	−7.3	94.5[10]	(Kremann, 1906)
Pyrocatechol (105°)	−13	80.5[11]	"
Resorcinol (110°)	not determined		((Kremann and Rodinis, 1906)
Nitrotoluene (51.3°)	−17	89	(Kremann, 1904)
Dinitrotoluene (71°), 1.3.4; 1.3.5 and 1.2.6	−13	80.8	(Kremann, 1906)
Trinitrotoluene (82°)	−8	96.4[12]	
Isopentane (less than −24°)	.		(Campetti and del Grosso, 1913)

[1] A second eutectic melts at 76° and contains 7 per cent $C_6H_5NH_2$, a molecular compound of m. pt. 92° and containing 24 per cent $C_6H_5NH_2$ exists between these eutectics. The author also gives data for the effect of nitrobenzene, *o* nitrophenol and of *m* xylene upon the lowering of the m. pt. of the above compound. [2] A break in the curve at 11.5° and 50.2 per cent $C_6H_5NH_2$ indicates that a molecular compound exists between the first eutectic and this point. [3] The first eutectic apparently lies too near pure aniline to be determined. An equi-molecular compound of aniline and *s* trinitrobenzene (m. pt. 30°) exists over the range pure aniline to the second eutectic which melts at 101° and contains 8.7 per cent $C_6H_5NH_2$. [4] A second eutectic melts at 0 and contains 28.7 per cent $C_6H_5NH_2$, the molecular compound between these points melts at 8.5° and contains 46.2 per cent $C_6H_5NH_2$. [5] A second eutectic melts at −31° and contains 17 per cent $C_6H_5NH_2$, the molecular compound between these points melts at −14.6° and contains 49 per cent $C_6H_5NH_2$. [6] The second eutectic melts at 6° and contains 23 per cent $C_6H_5NH_2$, the molecular compound melts at 19.2° and contains 47.5 per cent $C_6H_5NH_2$. [7] There are two eutectics between which an equi-molecular combination exists. [8] There is a break in the curve at 26° and 42.1 per cent $C_6H_5NH_2$ indicating the existence of a molecular compound from the eutectic up to this point. [9] There is a break in the curve at 42° and 39.8 per cent $C_6H_5NH_2$ indicating formation of a molecular compound. [10] There is a break in the curve at 71° and 32.9 per cent $C_6H_5NH_2$ indicating the existence of a molecular compound from the eutectic up to this point. [11] There is a break in the curve at 39° and 48.9 per cent $C_6H_5NH_2$. [12] A second eutectic melts at 60° and contains 7 per cent $C_6H_5NH_2$, the molecular compounds melts at 85° and contains 30 per cent $C_6H_5NH_2$.

RECIPROCAL SOLUBILITY OF ANILINE AND HEXANE.

(Keyes and Hildebrand, 1917.)

t° of Complete Miscibility.	Gms Hexane per 100 Gms Mixture.	t° of Complete Miscibility.	Gms Hexane per 100 Gms Mixture.
26.1	9.6	59.2	35.9
43.9	14.8	59.4	41.6
45.9	16.3	59.6	48
49.9	20	57.9	62.9
51.4	21	53.9	73.1
56	27.2	47.2	80.6
58.2	31	35.6	88.1
58.2	34.6	16.5	93.8

RECIPROCAL SOLUBILITY OF ANILINE AND PHENOL, DETERMINED BY THE FREEZING-POINT METHOD.

(Schreinemakers, 1899.)

t° of Melting.	Mols $C_6H_5NH_2$ per 100 Mols Mixture.	Solid Phase.	t° of Melting.	Mols $C_6H_5NH_2$ per 100 Mols Mixture.	Solid Phase.
− 6.1	100	$C_6H_5NH_2$	30.4 m. pt.	50	1.1
− 8.9	96	"	28.6	40	"
−11.7 Eutec.	92.3	$C_6H_5NH_2$+1.1	22.3	30	"
− 6.5	90	1.1	14.8 Eutec.	21.2	1.1+C_6H_5OH
+10.1	80	"	18.4	20	C_6H_5OH
22	70	"	31.4	10	"
28.5	60	"	37.3	4	"

1.1 = $C_6H_5NH_2.C_6H_5OH$.

Data for the solubility of aniline in cyclohexane at pressures up to 300 atmospheres are given by Kohnstamm and Timmermans (1913).

ANILINE HYDROCHLORIDE $C_6H_5NH_2.HCl$.

100 cc. H_2O dissolve 17.8 gms of the salt at 15°. (Niementowski and Roszkowski, 1897.)
100 gms H_2O dissolve 107.1 gms of the salt at 25°. (Peddle and Turner, 1913.)
100 gms sat. solution in water contain 52.1 gms $C_6H_5NH_2.HCl$ at 25°.
100 gms. sat. solution in aniline contain 8.89 gms $C_6H_5NH_2.HCl$ at 25°.
(Sidgwick, Pickford and Wilsden, 1911.)

DISTRIBUTION OF ANILINE HYDROCHLORIDE BETWEEN WATER AND ANILINE AT 25°.

(Sidgwick, Pickford and Wilsden, 1911.)

C_{aq}	C_{an}	C_{aq}/C_{an}	C_{aq}	C_{an}	C_{aq}/C_{an}	C_{aq}	C_{an}	C_{aq}/C_{an}
0.11	0.006	19.30	0.6	0.219	2.74	1	0.804	1.24
0.2	0.020	10	0.7	0.327	2.14	1.1	1.005	1
0.3	0.043	6.98	0.8	0.471	1.70	1.2	1.228	0.98
0.4	0.086	4.65	0.9	0.631	1.43	1.3	1.412	0.92
0.5	0.146	3.42						

C_{aq} = gms. salt per 100 gms. aq. layer. C_{an} = gms. salt per 100 gms. aniline layer.

NitrANILINES $C_6H_4NH_2NO_2$. *o*, *m*, and *p*.

SOLUBILITY IN WATER.

(Carnelly and Thomson — J. Chem. Soc. 53, 768, '88; Vaubel — J. pr. Chem. [2] 52, 73, '95; above 20°, Lowenherz — Z. physik. Chem. 25, 407, '98.)

t°.	Grams Nitraniline per Liter of Solution. Ortho Nitraniline.	Meta Nitraniline.	Para Nitraniline.
20	...	1.14–1.67	0.77–0.80
24.2	1.25 (25°)	1.205	...
27.3	...	1.422	...

100 cc. H_2O dissolve 2.2 gms. *p* nitraniline at 100°. (Jaeger and Kregten, 1912.)

Solubility of Ortho and of Meta Nitraniline in Hydrochloric Acid.

(Lowenherz.)

Ortho Nitraniline at 25°.

G. Mols. per Liter HCl	G. Mols. per Liter $C_6H_5NH_2NO_2(o)$	Grams per Liter HCl	Grams per Liter $C_6H_5NH_2NO_2(o)$
0.0	0.0091	0.0	1.25
0.63	0.0143	22.97	1.97
0.95	0.0174	34.63	2.40
1.26	0.0215	45.94	2.97

Meta Nitraniline.

t°.	G. Mols. per Liter HCl	G. Mols. per Liter $C_6H_5NH_2NO_2(m)$	Grams per Liter HCl	Grams per Liter $C_6H_5NH_2NO_2(m)$
(25°)	0.0	0.0091	0.0	1.20
(26.5°)	0.0125	0.0183	0.46	2.53
(23.3°)	0.0247	0.0274	0.90	3.85

Solubility Data Determined by the Freezing-Point Method Are Given for the Following Mixtures.

o Nitraniline + *m* Nitraniline	(Kremann, 1910, Valeton, 1910, Holleman, Hartogs and van der Linden, 1911, Nichols, 1918)
o " + *p* "	"
m " + *p* "	"
o " + *o* Nitracentanilide	(Jaeger, 1906)
p " + *p* Nitrosoaniline	(Jaeger and van Kregten, 1912)
o " + Benzene	(Bogojawlensky, Winogradow and Bogalubow, 1906)
m " + "	" " "
p " + "	" " "
o " + Nitrobenzene	" " "
m " + "	" " "
p " + "	" " "
o " + Ethylenebromide	" " "
m " + "	" " "
p " + "	" " "
m " + *m* Dinitrobenzene	(Crompton and Whitely, 1895)
m " + *s* Trinitrobenzene	(Smith and Walts, 1910, Sudborough and Beard, 1910)
p " + *s* "	" " " "
m " + Naphthalene	(Pushin and Grebenschikov, 1913)
o " + Phenol	(Kremann and Rodinis, 1906)
m " + "	" "
p " + "	" "
s Tribromaniline + 2 Chlor, 4 6 Dibromaniline	(Sudborough and Lakhamalani, 1917)
p Nitroethylaniline + *p* Nitrosoethylaniline	(Jaeger and van Kregten, 1912)
p " propylaniline + *p* Nitrosopropylaniline	"
Nitrodiethylaniline + Nitrosodiethlyaniline	(Jaeger, 1905, 1907)
Methylaniline + Benzylchloride	(Wroczynski and Guye, 1910)
Dimethylaniline + Benzene	(Schmidlin and Lang, 1912)
" + Tetramethyldiaminobenzophenone	" "
" + Phenol	(Bramley, 1916; Kremann, 1906)
" + *o* Chlorophenol	(Bramley, 1916)
Tetranitromethylaniline + *α* Trinitrotoluene	(Giua, 1915)
" + *p* Nitrotoluene	"
Nitrosodimethylaniline + *β* Naphthylamine	(Kremann, 1904)
" + Phenol	"
" + *o* Toluidine	"
" + *p* "	"
" + *m* Xylidine	"

SOLUBILITY OF META AND OF PARA NITRANILINE IN ORGANIC SOLVENTS AT 20°.
(Carnelly and Thomson.)

Solvent	Gms. per Liter Meta	Gms. per Liter Para	Solvent.	Gms. per Liter Meta	Gms. per Liter Para
Methyl Alcohol	110.6	95.9	Benzene	24.5	19.8
Ethyl Alcohol	70.5	58.4	Toluene	17.1	13.1
Propyl Alcohol	56.5	43.5	Cumene	11.5	9.0
Iso Butyl Alcohol	26.4	19.1	Chloroform	30.1	23.1
Iso Amyl Alcohol	85.1	62.9	Carbon Tetra Chloride	2.1	1.7
Ethyl Ether	78.9	61.0	Carbon Disulfide	3.3	2.6

ANILINE SULFATE $C_6H_5NH_2.H_2SO_4$.

100 cc. H_2O dissolve 6.6 gms. $C_6H_5NH_2.H_2SO_4$ at 15°.
(Niementowski and Roszkowski, 1897.)

ANISIC ACID (*p*-Methoxybenzoic Acid) $CH_3O.C_6H_4COOH$.

1000 cc. sat. aqueous solution contain 0.2263 gm. acid at 25°. (Paul, 1894.)

SOLUBILITY OF ANISIC ACID IN SEVERAL ALCOHOLS.
(Timofeiew, 1894.)

t°	In Methyl Alcohol. Gms. per 100 Gms. Sat. Sol.	In Methyl Alcohol. Gms. per 100 Gms. Solvent.	In Ethyl Alcohol. Gms. per 100 Gms. Sat. Sol.	In Ethyl Alcohol. Gms. per 100 Gms. Solvent.	In Propyl Alcohol. Gms. per 100 Gms. Sat. Sol.	In Propyl Alcohol. Gms. per 100 Gms. Solvent.
0	51.1	104.5	46.7	87.6	35	53.8
16.5	64.9	183.5	53.6	115.5	43	75.5

Data for the distribution of anisic acid between water and olive oil at 25° are given by Boeseken and Waterman (1911, 1912).

p **ANISIDINE** $C_6H_4(OCH_3)NH_2$.

DISTRIBUTION BETWEEN BENZENE AND WATER AT 25°.
(Farmer and Warth, 1904.)

Gms. $C_6H_4(OCH_3)NH_2$ per 100 cc. C_6H_6 Layer	Gms. $C_6H_4(OCH_3)NH_2$ per 100 cc. H_2O Layer
0.4350	0.0747
0.6662	0.1112
0.9010	0.1472

ANISOLE $C_6H_5OCH_3$.

RECIPROCAL SOLUBILITY OF ANISOLE AND BENZYL CHLORIDE DETERMINED BY THE FREEZING-POINT METHOD.
(Wroczynski and Guye, 1910.)

t° of Melting	Gms. $C_6H_5OCH_3$ per 100 Gms. Mixture	Solid Phase	t° of Melting	Gms. $C_6H_5OCH_3$ per 100 Gms. Mixture	Solid Phase
−37.2	100	$C_6H_5OCH_3$	−72.8 Eutec.	46.1	$C_6H_5OCH_3+C_6H_5CH_2Cl$
−40	93.3	"	−60	28	$C_6H_5CH_2Cl$
−50	75.3	"	−50	13	"
−60	62.1	"	−41.1	0	"

p Nitr**ANISOLE** $C_6H_4NO_2.OCH_3$.

FREEZING-POINT CURVES (Solubilities, see footnote, page 1) ARE GIVEN FOR THE FOLLOWING MIXTURES.

p Nitranisole + Mercuric Chloride (Mascarelli, 1908, 1909, Mascarelli and Ascoli, 1907.)
" + Urethan (Mascarelli, 1908, 1909, Pushin and Grebenschukov, 1913.)
" + " + $HgCl_2$ (Mascarelli, 1908, 1909.)
" + Diphenylamine (Pushin and Grebenschukov, 1913.)
Dinitranisole + Dinitrophenetol (Blanksma, 1914.)

ANTHRACENE $C_{14}H_{10}$

SOLUBILITY OF ANTHRACENE IN SEVERAL SOLVENTS.

Solvent	t°	Gms $C_{14}H_{10}$ per 100 Gms. Solvent	Authority.
Ethyl Alcohol (abs.)	16	0.076	(v Becchi)
" " "	19.5	1.9	(de Bruyn, 1892)
" " "	25	0.328	(Hildebrand, Ellefson and Beebe, 1917.)
" " "	b. pt.	0.83	(v Becchi)
Methyl Alcohol (abs.)	19.5	1.8	(de Bruyn 1892)
Benzene	25	1.86	(Hildebrand, Ellefson and Beebe, 1917)
Carbon Disulphide	25	2.58	" " "
Carbon Tetrachloride	25	0.732	" " "
Ether	25	1.42	" " "
Hexane	25	0.37	" " "
95% Formic Acid	18.3	0.03	(Aschan, 1913)
Toluene	16.5	0.92	(v Becchi)
"	100	12.94	"
Trichlorethylene	15	1.01	(Wester and Bruins, 1914)

SOLUBILITY OF ANTHRACENE IN BENZENE AND IN MIXTURES OF BENZENE AND PENTANE AND OF BENZENE AND HEPTANE.

(Tyrer, 1910, and private communication See Note, p 147)

	In Benzene.		In Benzene + Pentane at 15°.		In Benzene + Heptane at 14° and 70°.		
t°	d of Sat. Sol.	Gms $C_{14}H_{10}$ per 100 Gms Solvent	% C_6H_6 in Solvent	Gms. $C_{14}H_{10}$ per 100 Gms Solvent.	% C_6H_6 in Solvent	Gms. $C_{14}H_{10}$ per 100 Gms Solvent at 14°.	at 70°.
0	0.9008	0.605	0	0.184	0	0.210	1.67
10	0.8909	0.975	10	0.225	12.5	0.284	2.10
20	0.8812	1.43	20	0.279	25	0.372	2.64
30	0.8717	2.03	30	0.357	37.5	0.474	3.23
40	0.8627	2.78	40	0.447	50	0.592	3.87
50	0.8541	3.75	50	0.549	62.5	0.718	4.59
60	0.8460	5.14	60	0.600	75	0.850	5.37
70	0.8374	7	70	0.780	87.5	0.976	6.15
75	0.8347	8.35	80	0.915	100	1.180	6.93
			90	1.059			
			100	1.225			

Results for the solubility in benzene, differing from the above in some cases by 15%, are given by Findlay (1902)

SOLUBILITY OF ANTHRACENE IN ALCOHOLIC PICRIC ACID SOLUTIONS AT 25°.

(Behrend — Z. physik Chem 15, 187, '94)

Grams per 100 Grams Solution: Picric Acid	Anthracene	Solid Phase.	Grams per 100 Gms Solution: Picric Acid	Anthracene	Solid Phase
0	0.176	Anthracene	3.999	0.202	Anthracene Picrate
1.017	0.190	"	5.087	0.180	"
2.071	0.206	"	5.843	0.162	"
2.673	0.215	"	6.727	0.151	"
3.233	0.228	"	7.511	0.149	Anthracene Picrate + Picric Acid
3.469	0.236	Anthracene and Anthracene Picrate	7.452	0	Picric Acid

SOLUBILITY IN LIQUID SULFUR DIOXIDE IN THE CRITICAL REGION.
(Centnerswer and Teletow, 1903)

Weighed amounts of anthracene and liquid SO_2 were placed in glass tubes which were sealed and rotated at a gradually increasing temperature, and the point observed at which the solid disappeared.

t°.	Gms $C_{14}H_{10}$ per 100 Gms SO_2	t°.	Gms $C_{14}H_{10}$ per 100 Gms SO_2	t°.	Gms $C_{14}H_{10}$ per 100 Gms SO_2.
40.1	2.11	65	4	98	9.36
45.8	2.48	78.2	5.66	99.1	9.95
47.9	2 65	88	7.14	106.5	12.78

Freezing-point curves are given for mixtures of anthracene and each of the following compounds: Diphenyl, diphenylamine, α and β naphthylamines, α and β naphthols, resorcinol, *p* toluidine and triphenyl methane (Vignon, 1891); Naphthalene (Vignon and Miolati, 1892); Phenanthene (Vignon, 1891, Garelli, 1894); Picric acid (Kremann, 1905).

ANTHRAQUINONE $(C_6H_4)_2(CO)_2$.

SOLUBILITY IN LIQUID SULFUR DIOXIDE IN THE CRITICAL REGION.
(Centnerswer and Teletow, 1908) (See Anthracene, above)

t°	Gms $C_{14}H_8O_2$ per 100 Gms SO_2	t°.	Gms $C_{14}H_8O_2$ per 100 Gms SO_2	t°.	Gms. $C_{14}H_8O_2$ per 100 Gms SO_2.
3 96	0 64	92.1	2.81	118.5	5 60
51.5	0.88	101.4	3.67	141.6	7.53
67.9	1.73	106.3	4 23	160	9 60
82.4	2.24	108 7	4 40	179	12 70
				183.7	18 30

100 parts of absolute ethyl alcohol dissolve 0.05 part anthraquinone at 18° and 2.249 parts at b. pt. (v Bechi)

100 gms. alcohol dissolve 0.437 gm. anthraquinone at 25°.
(Hildebrand, Ellefson and Beebe, 1917.)

SOLUBILITY OF ANTHRAQUINONE IN BENZENE AND IN CHLOROFORM.
(Tyrer, 1910)

	In Benzene.			In Chloroform.	
t°.	Sp Gr Solution	Gms $C_{14}H_8O_2$ per 100 Gms C_6H_6	t°	Sp Gr Solution.	Gms $C_{14}H_8O_2$ per 100 Gms $CHCl_3$
0	0.8900	0 110	0	1.5244	0.340
20	0 8794	0.256	10	1.5046	0 457
30	0 8692	0.350	20	1.4850	0 605
40	0.8591	0 495	30	1.4656	0 780
50	0 8439	0.700	40	1.4461	0 994
60	0.8389	0 974	50	1.4261	1 256
70	0.8288	1.355	55	1.4164	1.415
80	0.8190	1.775	60	1.4070	1.577

SOLUBILITY OF ANTHRAQUINONE IN A MIXTURE OF CHLOROFORM AND HEXANE AT 12.6° AND 49°.
(Tyrer, 1910, also private communication See Note, p 447)

% $CHCl_3$ in Solvent	Gms $C_{14}H_8O_2$ per 100 Gms. Solvent at 12 6°	49 0°.	% $CHCl_3$ in Solvent.	Gms $C_{14}H_8O_2$ per 100 Gms. Solvent at 12 6°	49 0°
0	0.006	0 056	60	0.101	0.292
10	0.016	0.074	70	0.148	0 417
20	0.024	0.096	80	0.222	0.608
30	0.034	0.124	90	0.334	0 852
50	0.068	0.212	100	0.482	1.209

SOLUBILITY OF ANTHRAQUINONE IN ETHER.

(Smits — Z Electrochem. 9, 663, '03)

Weighed amounts of ether and anthraquinone were placed in glass tubes which were then sealed. The temperature noted at which the anthraquinone disappeared and also at which the liquid phase disappeared (critical temp.). The two curves cross at 195° and again at 241°. Between these two temperatures the critical curve lies below the solubility curve, hence for this range of temperature no solubility curve is shown. The following figures were read from the curves, and are therefore only approximately correct.

t°.	Gms. $C_{14}H_8O_2$ per 100 g Solution.	t°.	Gms $C_{14}H_8O_2$ per 100 g Solution.	t°	Gms $C_{14}H_8O_2$ per 100 g Solution
130	3	241	30	260	80
150	4	245	40	270	90
170	4 5	247	50	275	100
195	5 0	250	60		

100 parts of toluene dissolve 0 19 part anthraquinone at 15° and 5 56 parts at 100° (v Becchi).

100 gms. ether dissolve 0 104 gm anthraquinone at 25°

(Hildebrand, Ellefson and Beebe, 1917)

Data for the solubility of anthraquinone in mixtures of phenol and water are given by Timmermanns (1907).

Hydroxy **ANTHRAQUINONES** $C_6H_4 < (CO)_2 > C_6H_3OH$

1000 cc H_2O dissolve 0 0035 gm. α oxyanthraquinone at 25°. (Hüttig, 1914)

1000 cc. H_2O dissolve 0 0011 gm β oxyanthraquinone at 25°. "

1000 cc H_2O dissolve 0 000012 0 000062 gm 1 4 dioxyanthraquinone (= chinizarin) at 25°.

1000 cc. H_2O dissolve 0.00158 gm. 1 6 dioxyanthraquinone (= chrysazin) at 25°.

(Hüttig, 1914)

ANTHRAFLAVINE (2.6 Dioxyanthraquinone) $C_{12}H_6(CO)_2(OH)_2$.

1000 cc. H_2O dissolve 0 0003 gm. anthraflavine at 25°. (Hüttig, 1914)

ANTHRARUFINE (1 5 Dioxyanthraquinone) $C_{12}H_6(CO)_2(OH)_2$

1000 cc. H_2O dissolve 0 000285 gm anthrarufine at 25°. (Hüttig, 1914.)

ANTIMONY Sb.

Fusion-point data for mixtures of antimony and iodine are given by Jaeger and Dornbosch (1912), for mixtures of antimony and sulphur by Jaeger and Van Klooster (1912), and for mixtures of antimony, iodine and arsenic by Quercigh (1912).

ANTIMONY Tri**BROMIDE** $SbBr_3$.

SOLUBILITY IN BENZENE DETERMINED BY "SYNTHETIC METHOD."

(Menschutkin, 1910)

t°	Gms $SbBr_3$ per 100 Gms Sat Sol	Solid Phase	t°.	Gm $SbBr_3$ per 100 Gms Sat Sol	Solid Phase
5.6 m. pt.	0	C_6H_6	90	83	$2SbBr_3.C_6H_6$
4 5 Eutec.	8.3	$C_6H_6+2SbBr_3.C_6H_6$	92 5 m. pt.	90 2	"
15	12 5	$2SbBr_3.C_6H_6$	91 5	92.8	"
35	23	"	90	93 8	"
55	39	"	85 Eutec.	96 3	$2SbBr_3.C_6H_6+SbBr_3$
75	60 5	"	90	98	$SbBr_3$
85	74.3	"	94	100	"

RECIPROCAL SOLUBILITIES OF ANTIMONY TRIBROMIDE AND VARIOUS ORGANIC COMPOUNDS, DETERMINED BY THE "SYNTHETIC METHOD."

(Menschutkin, 1911)

$SbBr_3$ + Acetic Acid.		$SbBr_3$ + Benzoic Acid.		$SbBr_3$ + Benzoyl Chloride.		$SbBr_3$ + Benzene Sulphonic Acid.	
t°.	Gms $SbBr_3$ per 100 Gms. Sat Sol.	t°.	Gms $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms $SbBr_3$ per 100 Gm. Sat. Sol
16.5 *	0	120 *	0	− 0.5 *	0	52.5 *	0
15	12.2	115	20.1	− 3	19.5	50	15.8
10	41.8	110	36.8	− 6 †	32	47.5	26.2
4 †	58.2	105	50	+10	41.2	44 †	36.9
20	64.3	100	61.5	20	47.5	50	39.1
40	72.5	95	71	30	54	60	45.7
60	81.9	85	83.1	40	60.8	70	55.2
70	97.1	79 †	87.6	50	67.8	80	68.1
80	92.4	85	92	60	74.9	85	77.6
90	97.8	90	96.4	80	89.4	90	90.3
94	100	94	100	94	100	94	100

Molecular compounds are not formed in the above systems. The diagram in each case consists of two arms meeting at the eutectic.

$SbBr_3$ + Acetophenone.			$SbBr_3$ + Amylbenzene.			$SbBr_3$ + Anisole.		
t°.	Gms $SbBr_3$ per 100 Gms Sat Sol	Solid Phase.	t°.	Gms $SbBr_3$ per 100 Gms Sat Sol	Solid Phase	t°	Gms $SbBr_3$ per 100 Gms Sat Sol	Solid Phase.
19.5 *	0	$C_6H_5COCH_3$	−70	4.5	$SbBr_3.C_6H_5.C_5H_{11}$	−34 *	0	$C_6H_5OCH_3$
15	22.7	"	−50	8.3	"	−35	2.5	"+1.1
1.5 *	48.6	" +1.1	−30	16.6	"	−20	11.7	1.1
20	56.8	1.1	−25	21	"	0	26.5	"
30	63.3	"	−17 ‡	32.5	"+$SbBr_3$	10	37.1	"
37.5 *	75	"	−10	33.5	$SbBr_3$	20	50.5	"
31 †	83.2	1.1+$SbBr_3$	0	35.6	"	25	59	"
40	84.6	$SbBr_3$	20	41.6	"	30.5 *	77	"
60	88.4	"	40	51.3	"	30 †	77.9	"+$SbBr_3$
80	94.1	"	60	65	"	40	80.6	$SbBr_3$
94	100	"	80	84	"	60	86.4	"
						80	93.6	"

$SbBr_3$ + Benzaldehyde.			$SbBr_3$ + Benzonitrile.			$SbBr_3$ + Benzophenone.		
t°.	Gms $SbBr_3$ per 100 Gms Sat Sol.	Solid Phase.	t°.	Gms $SbBr_3$ per 100 Gms Sat Sol	Solid Phase	t°	Gms $SbBr_3$ per 100 Gms Sat Sol	Solid Phase.
−20	38.4	1.1	−13.2 *	0.0	C_6H_5CN	48 *	0	$C_6H_5CO.C_6H_5$
0	45.5	"	−16	19.2	"	40	24	"
20	54.3	"	−18 †	28.7	"+1.1	29 †	41.2	"+1.1
35	64.1	"	0	43	1.1	40	50	1.1
40	70.3	"	20	59	"	45	56.3	"
41.5 *	77.2	"	30	67	"	48.5 *	66.4	"
37.8 †	84.4	1.1+$SbBr_3$	38 *	77.8	"	45	76	"
55	88	$SbBr_3$	35 †	82.5	1.1+$SbBr_3$	40	80	1.1+$SbBr_3$
75	93.1	"	55	87.5	$SbBr_3$	50	82.6	$SbBr_3$
85	96.1	"	75	93.3	"	70	88.7	"
90	98.2	"	85	96.5	"	80	92.4	"
94	100	"	90	98.3	"	90	97.3	"
			94	100	"	94	100	"

* m. pt. † Eutec. ‡ tr. pt.

1.1 = compound of equimolecular amounts of the two constituents in each case.

RECIPROCAL SOLUBILITIES OF ANTIMONY TRIBROMIDE AND VARIOUS ORGANIC COMPOUNDS, DETERMINED BY THE "SYNTHETIC METHOD."

(Menschutkin, 1910.)

$SbBr_3$ + Brombenzene.		$SbBr_3$ + Chlorbenzene.		$SbBr_3$ + Iodobenzene.		$SbBr_3$ + Fluorbenzene.	
t°.	Gms $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms $SbBr_3$ per 100 Gms. Sat. Sol.
−31 *	0	−45.2 *	0	−28.6 *	0	−30.2 *	0
−32	5.7	−47 †	5.2	−30.3	7.0	−30.5 †	1.3
−25 †	9.5	−40	6.8	−32 †	14.3	−25	4.3
−15	15	−30	9.6	−20	21.6	−15	6.7
− 5	20.8	−20	12.6	−10	27.5	+ 5	11.6
+ 5	26.8	−10	16	0	33.4	25	21.8
15	33	0	20	+10	39.3	45	33.3
25	39.6	20	30	20	45.2	55	45.5
45	54.6	40	45.4	40	57.6	65	60.8
65	71.9	60	65.8	60	71.1	75	81.8
85	90.7	80	86.3	80	86.3	85	93.5
94	100	94	100	94	100	94	100

$SbBr_3$ + *p* Dibrombenzene.		$SbBr_3$ + *p* Dichlorbenzene.		$SbBr_3$ + Nitrobenzene.		$SbBr_3$ + *m* Dinitrobenzene.	
t°.	Gms $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms $SbBr_3$ per 100 Gms. Sat. Sol.
88 *	0	54.5 *	0	6 *	0	90 *	0
85	10	51.5	14	1	22	80	20.1
80	25.2	48.5 †	26.5	− 4	37.4	70	50
75	39.2	55	35.9	− 9	48.4	60	63
70	52	60	43.1	−14.5 †	55.3	50	70.8
65 †	62.2	65	50.7	− 5	58.3	47.5 †	72
70	68.7	70	58.8	+ 5	61.5	50	73.4
75	75.3	75	67.2	25	68.6	60	78.2
80	81.8	80	75.8	45	76.6	70	84
85	88.3	85	84.5	65	85.3	80	90.4
90	94.3	90	93.4	85	94.7	90	96.8
94	100	94	100	94	100	94	100

Molecular compounds are not formed in the above systems. The diagram in each case consists of two arms meeting at the eutectic.

$SbBr_3$ + Ethylbenzene.			$SbBr_3$ + Propylbenzene.			$SbBr_3$ + *p* Cymene.		
t°.	Gms $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−93 *	0	$C_6H_5C_2H_5$	−80	1.3	1.1	−75 *	0	
−93.2 †	0.4	" +1.1	−60	3.7	"	−77 †	2	
−70	1	1.1	−40	9.4	"	−50	6.1	1.1
−50	2.2	"	−20	22.5	"	−30	12.3	"
−30	4.8	"	−10	38.4	"	−10	27	"
−10	12	"	− 5 ‡	40	1.1+$SbBr_3$	0	42.3	"
+10	29.2	"	+10	53.3	$SbBr_3$	+5 ‡	51.5	1.1+$SbBr_3$
20	46.3	"	20	57.1	"	20	56	$SbBr_3$
29 ‡	69.7	1.1+$SbBr_3$	40	66.2	"	40	64.1	"
50	78.2	$SbBr_3$	60	77.2	"	60	75	"
70	87.3	"	80	89.8	"	80	88.5	"
90	97.7	"	94	100	"	94	100	"

* m. pt. † Eutec. ‡ tr. pt.

1.1 = compound of equimolecular amounts of the two constituents in each case.

RECIPROCAL SOLUBILITIES OF ANTIMONY TRIBROMIDE AND VARIOUS ORGANIC COMPOUNDS, DETERMINED BY THE "SYNTHETIC METHOD."

(Menschutkin, 1911.)

$SbBr_3$ + Cyclohexane.

t°.	Gms $SbBr_3$ per 100 Gms Sat Sol	Solid Phase.
6.4*	0	C_6H_{12}
6†	0.3	C_6H_{12} + $SbBr_3$
20	1.4	$SbBr_3$
40	3.7	"
60	7.1	"
80	12.5	"
liquid layers formed		
92.5	17.4	97.6
110	25.8	96.5
130	36.4	95
150	47.8	92.7
170	62.3	86.3
175‡	74.0	

$SbBr_3$ + Pseudo Cymene.

t°.	Gms $SbBr_3$ per 100 Gms Sat Sol	Solid Phase
−57.2*	0	$C_6H_3(CH_3)_3$ 1, 2, 4
−58.8†	9.7	" +1.1
−50	11	1.1
−30	16.2	"
−10	31	"
0	47.6	"
7§	63.5	1.1+2.1
15	67.4	2.1
25	73	"
33§	79.1	2.1+$SbBr_3$
50	82.8	$SbBr_3$
70	88.4	"
90	97.4	"

$SbBr_3$ + Mesitylene.

t°.	Gms. $SbBr_3$ per 100 Gms Sat Sol	Solid Phase
−54.4*	0	$C_6H_3(CH_3)_3$ 1, 3, 5
−55.2†	2.1	" +1.1
−30	3.6	1.1
−10	9	"
+10	25.4	"
20	35.5	"
29‡	46.5	1.1+2.1
40	54.2	2.1
50	61.7	"
60	70.2	"
69.5*	85.8	"
69†	87.7	2.1+$SbBr_3$
80	92.7	$SbBr_3$

$SbBr_3$ + Diphenylmethane

t°.	Gms $SbBr_3$ per 100 Gms Sat Sol	Solid Phase
26*	0	$CH_2(C_6H_5)_2$
22.5†	12.8	" +2.1
40	22.8	2.1
50	29.5	"
60	37.5	"
70	47.8	"
80	60.2	"
90*	81.1	"
85	89.6	"
82†	92.2	2.1+$SbBr_3$
90	96.2	$SbBr_3$
94	100	"

$SbBr_3$ + Naphthalene.

t°.	Gms $SbBr_3$ per 100 Gms Sat Sol	Solid Phase
79.4*	0	$C_{10}H_8$
75	23.7	"
70	37.4	"
65	48.6	"
57	61.2	" +2.1
60	68	2.1
65	81.3	"
66*	84.9	"
65†	86.7	2.1+$SbBr_3$
75	90.1	$SbBr_3$
85	94.9	"
90	97.7	"

$SbBr_3$ + α Nitronaphthalene.

t°.	Gms $SbBr_3$ per 100 Gms Sat Sol	Solid Phase
57*	0.0	$\alpha C_{10}H_7NO_2$
50	23.2	"
40	42.6	"
33.5†	50.5	" +1.1
37.5	62.6	1.1 ¶
38.2*	67.6	"
38†	68	1.1+$SbBr_3$
50	73.4	$SbBr_3$
70	83.8	"
90	96.4	"

$SbBr_3$ + Diphenyl.

t°.	Gms $SbBr_3$ per 100 Gms Sat Sol	Solid Phase
70.5*	0	$C_6H_5C_6H_5$
60	35.7	"
50	54.3	"
47†	57.4	" +2.1
55	68.5	2.1
60.5*	82.7	"
70	86.5	$SbBr_2$
80	91.5	"
90	97.3	"
94	100	"

$SbBr_3$ + Phenol.

t°.	Gms $SbBr_3$ per 100 Gms Sat Sol	Solid Phase
41*	0	C_6H_5OH
35	22.5	"
30	40	"
28.5†	44.6	" +2.1
40	53	2.1
50	62.5	"
60	75.8	"
65	84.7	"
66.5*	88.5	"
75	91.7	$SbBr_3$
85	95.8	"
90	98.1	"

$SbBr_3$ + Phenetol.

t°.	Gms $SbBr_3$ per 100 Gms Sat Sol	Solid Phase
−28.6*	0	$C_6H_5OC_2H_5$
−29†	1.6	" +1.1
−10	4.8	1.1
+10	12.9	"
20	19.2	"
30	29.7	"
40	46.2	"
48.8*	74.7	"
47†	77.8	1.1+$SbBr_3$
60	83	$SbBr_3$
70	87.3	"
90	97.4	"

* m. pt. † Eutec. ‡ crit. t. § tr. pt.

¶ Not obtained regularly, in such cases, single eutectic at 23° and 61.5 per cent $SbBr_3$.

1.1 = compound of equimolecular amounts of the two constituents in each case.
2.1 = compound of 2 molecules of $SbBr_3$ with one molecule of the other constituent.

Reciprocal Solubilities of Antimony Tribromide in Various Organic Compounds, Determined by the "Synthetic Method"

(Menschutkin, 1910–12.)

$SbBr_3$ + α Bromnaphthalene.		$SbBr_3$ + α Chlornaphthalene.		$SbBr_3$ + β Chlornaphthalene.		$SbBr_3$ + Tetrahydrobenzene.	
t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.
3 *	0	−17 *	0	56 *	0	.	
0	15.8	−21	13.8	50	26.1	−5	11.7
−3.5 †	31.4	−24.5 †	22.6	45	38.5	15	13.1
15	38.7	−10	27.3	40	49	35	24.1
35	49.9	+10	35.5	37.5 †	53.6	55	[illegible]
45	56.9	30	46.7	45	58.8	65	[illegible]
55	64.7	50	61.6	55	66.8	70	64.5
65	72.9	60	69.9	65	75.2	75	76.[illegible]
75	81.8	70	78.6	75	83.8	80	84.1
80	86.3	80	87.5	80	88.1	85	90.7
85	90.8	90	96.6	85	92.1	90	95.8
90	95.4	94	100	90	96.7	94	100

$SbBr_3$ + o Chlortoluene.		$SbBr_3$ + m Chlortoluene.		$SbBr_3$ + p Chlortoluene.		$SbBr_3$ + m Nitrotoluene.	
t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.
−36.2 *	0	−47.8 *	0	6.[illegible] *	0	16 *	0
−38.5 †	10.7	−50 †	8.1	2.5 †	23.3	10	24.2
−20	15.4	−30	11.7	20	33	5	39
0	22.5	−10	17.5	30	39.3	0	46.6
+20	32.5	+10	25.8	40	47.2	−9 †	56.8
30	38.8	30	37.5	50	56.3	+10	62.7
40	46.8	40	45.1	60	66.7	30	69.7
50	56	50	54.4	70	77.8	50	77.5
60	66.5	60	65	80	88.2	60	81.5
70	77.8	70	77	90	97	70	86.3
80	88.2	80	88.2	94	100	80	91.4
90	97	90	97			90	97.[illegible]

Molecular compounds are not formed in the above systems. The diagram in each case consists of two arms meeting at the eutectic.

$SbBr_3$ + Toluene.			$SbBr_3$ + o Nitrotoluene.			$SbBr_3$ + p Nitrotoluene.		
t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $SbBr_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−93 *	0	$C_6H_5CH_3$	−8.5 *	0	$o\,NO_2C_6H_4CH_3$	52.5 *	0	$p\,NO_2C_6H_4CH_3$
−93.5 †	1.0	" +1.1	−13.5	10.5	" +1.1	45	29.8	"
−80	2.4	1.1	0	27.6	1.1	40	42.[illegible]	"
−60	6.2	"	10	35.6	"	35	50	"
−40	12.4	"	20	47.5	"	25	61	"
−20	25.7	"	25	55.7	"	16 †	67	" +$SbBr_3$
−1 ‡	53.1	1.1+2.1	31 ‡	70	" +$SbBr_3$	30	71.6	$SbBr_3$
+20	69.4	2.1	40	73.5	$SbBr_3$	50	78.9	"
30 ‡	78	2.1+$SbBr_3$	50	77.5	"	60	82.9	"
40	80.6	$SbBr_3$	60	81.7	"	70	87.2	"
60	86.6	"	80	91.4	"	80	92	"
80	93.8	"	90	97.2	"	90	97.5	"
94	100	"						

* m. pt. † Eutec. ‡ tr. pt.

1.1 = compound of equimolecular amounts of the two constituents in each case.
2.1 = compound of 2 molecules of $SbBr_3$ with 1 molecule of the other constituent.

RECIPROCAL SOLUBILITIES OF ANTIMONY TRIBROMIDE AND VARIOUS ORGANIC COMPOUNDS, DETERMINED BY THE "SYNTHETIC METHOD."

(Menschutkin, 1910 11)

$SbBr_3$ + Triphenylmethane.		$SbBr_3$ + *o* Xylene.		$SbBr_3$ + *m* Xylene.		$SbBr_3$ + *p* Xylene.	
t°.	Gms $SbBr_3$ per 100 Gms Sat Sol	t°.	Gms $SbBr_3$ per 100 Gms Sat. Sol	t°.	Gms $SbBr_3$ per 100 Gms Sat Sol	t°	Gms $SbBr_3$ per 100 Gms. Sat Sol
92 *	0	−29 *	0	−57 *	0	14 *	0
85	18	−33 †	10 5	−59 2 †	5 5	12	16 6
80	30 1	−20	17	−45	10	10 †	28
70	47	−10	24 6	−35	14 2	20	36
60	58 2	0	34 5	−25	20	30	44 6
48 †	67 1	20	65 8	− 5	38 8	40	53 8
60	73 3	24 *	77 2	+ 5	56 6	50	63 5
70	79 5	22 5 †	78 6	12 5 ‡	75 4	60	74
80	86 4	30	80	25	77 6	67 5 *	87 3
90	95 2	50	84 7	45	82 3	66 5 †	88 3
94	100	70	90 1	65	87 9	75	91 4
		90	97 7	87	95 3	85	95 7

* m pt   † Eutec   ‡ tr pt

In the case of each of the above xylenes the compound existing between the first and second eutectic consists of equimolecular amounts of $SbBr_3$ and xylene.

Solubility data determined by the freezing-point method (see footnote, page 1) are given for mixtures of antimony tribromide and each of the following compounds: azobenzene, benzil, s diphenylethane and stilbene (Van Stone, 1914), aniline, benzophenone, triphenylmethane and toluene. (Kurakov, Krotkov and Oksman, 1915)

ANTIMONY TriCHLORIDE $SbCl_3$.

SOLUBILITY IN WATER. SOLID PHASE $SbCl_3$.

(Meerburg — Z anorg. Chem. 33, 299, 1903)

t°.	Mols $SbCl_3$ per 100 Mols H_2O.	Gms $SbCl_3$ per 100 g H_2O.	t°.	Mols $SbCl_3$ per 100 Mols H_2O.	Gms $SbCl_3$ per 100 g H_2O
0	47 9	601 6	35	91 6	1152 0
15	64 9	815 8	40	108 8	1368 0
20	72.4	910.1	50	152 5	1917 0
20	74 1	931 5	60	360 4	4531 0
25	78 6	988 1	72	∞	∞
30	84 9	1068 0			

SOLUBILITY OF ANTIMONY TRICHLORIDE IN AQUEOUS HYDROCHLORIC ACID. SOLID PHASE $SbCl_3$. TEMP. 20°.

(Meerburg)

Mols per 100 Mols. H_2O.		Gms per 100 g H_2O.		Mols per 100 Mols H_2O.		Gms per 100 g H_2O.	
HCl.	$SbCl_3$.	HCl	$SbCl_3$.	HCl.	$SbCl_3$.	HCl.	$SbCl_3$.
0	72.4	0.0	910 1	9.1	68 9	18 41	866 4
2.4	71.2	4 86	895 4	11.7	68.1	23.68	856.3
6.1	69 9	12.34	879 0	28.7	62.8	58.08	789.8
8 3	68.2	16.80	857 6				

100 gms. absolute acetone dissolve 537.6 gms. $SbCl_3$ at 18°. d_{18} sat. sol. = 2.216. (Naumann, 1904)

100 gms. ethyl acetate dissolve 5.9 gms. $SbCl_3$ at 18° d sat. sol. = 1.7968. (Naumann, 1910)

Reciprocal Solubilities of Antimony Trichloride and Various Organic Compounds, Determined by the "Synthetic Method."

(Menschutkin, 1911.)

$SbCl_3$ + Acetic Acid.

t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.	Solid Phase.
16.5*	0	CH_3COOH
10	22.7	"
0	42.5	"
−5	48.5	"
−9†	52.7	" +1.1
0	59	1.1
10	67.3	"
19*	79.1	"
25	81.5	$SbCl_3$
45	87.4	"
65	95.3	"
73	100	"

$SbCl_3$ + Acetophenone.

t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.	Solid Phase.
19.5*	0	$C_6H_5COCH_3$
15	14.3	"
5	28.5	"
1†	31.8	" +1.1
15	35.4	1.1
35	41.6	"
55	55.2	"
60.5*	65.4	"
45	79.3	"
32†	84	1.1+$SbCl_3$
50	89.3	$SbCl_3$
70	98.2	"

$SbCl_3$ + Anisol.

t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.	Solid Phase.
−31*	0	$C_6H_5OCH_3$
−36.5†	11.8	" +1.1
−30	16	1.1
−10	28.3	"
+10	43	"
20	52.8	"
25‡	63.6	" +2.1
35	70	2.1
41.5*	80.9	"
40†	84.5	" +$SbCl_3$
60	92	$SbCl_3$
70	98	"

$SbCl_3$ + Aniline.

t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.	Solid Phase.
−7.2†	1	$C_6H_5NH_2$+1.4
+20	7	1.4
60	18.7	"
77‡	29.6	1.4+1.3
88*	44.8	1.3
87†	46.3	1.3+1.2
94.5*	54.9	1.2
89.5†	61.7	1.2+1.1
100.5*	71	1.1
70	82.2	"
31†	88	1.1+$SbCl_3$
60	94.9	$SbCl_3$

$SbCl_3$ + Benzaldehyde.

t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.	Solid Phase.
10	43.5	1.1
20	47.5	"
30	52.4	"
40	60.2	"
43.5*	68.1	"
40	74.2	"
30	80.6	"
25†	83	1.1+$SbCl_3$
35	85	$SbCl_3$
45	87.5	"
65	95.2	"
73	100	"

$SbCl_3$ + Benzophenone.

t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.	Solid Phase.
48*	0	$C_6H_5COC_6H_5$
40	16.3	"
35†	21.6	" +1.1
45	26.2	1.1
55	31.4	"
65	37.5	"
70*	55.4	"
65	71.6	"
45	80.6	"
39†	82.7	" +$SbCl_3$
50	87	$SbCl_3$
70	97.7	"

1.1 = compound of equimolecular amounts of the two constituents in each case.

2.1 = compound of 2 molecules of $SbCl_3$ with 1 molecule of the other constituent.

1.2, 1.3 and 1.4 = compounds of 1 molecule of $SbCl_3$ with 2, 3 and 4 molecules of aniline.

$SbCl_3$ + Benzoic Acid.		$SbCl_3$ + Benzoyl Chloride.		$SbCl_3$ + Benzene Sulphonic Acid.		$SbCl_3$ + Tetrahydrobenzene.	
t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.	t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.	t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.	t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.
120	0	−5	17.8	52.5*	0	−25	19.1
110	23	−15	36.8	45	18	−15	24
100	38.8	−23†	45	25	43.7	−5	30
90	50	−5	50.7	5	56.1	+5	37.1
80	59	+15	58.2	−5†	60.8	15	45.1
70	66	25	62.9	+5	49.8	25	51.3
60	71.6	35	68.1	25	56.7	35	64.5
46†	78	45	74.9	45	69.2	45	74
60	89.2	55	82.1	65	90.2	55	83.6
70	97.5	70	96.5	73	100	65	92.8

Molecular compounds are not formed in the above systems. The diagram in each case consists of two arms meeting at the eutectic.

* m. pt. † Eutec. ‡ tr. pt.

Reciprocal Solubilities of Antimony Trichloride and Various Organic Compounds, Determined by the "Synthetic Method."

(Menschutkin, 1910-'11)

$SbCl_3$ + Benzene.

t°.	Gms $SbCl_3$ per 100 Gms. Sat Sol	Solid Phase.
4 *	7.3	C_6H_6
1	19.4	" +2.1
10	24.6	2.1
20	30.5	"
40	44.1	"
60	60.6	"
75	76.8	"
79 †	85.3	"
70	93.5	"
62 *	96	2.1+$SbCl_3$
67.5	97.9	$SbCl_3$

$SbCl_3$ + Brombenzene.

t°.	Gms $SbCl_3$ per 100 Gms Sat Sol	Solid Phase.
−31 †	0	C_6H_5Br
−32.5 *	4.8	" +1.1
−30	6.8	1.1
−20	14.8	"
−10	23.9	"
0	34.3	"
+ 3 ‡	40.3	1.1+$SbCl_3$
20	52	$SbCl_3$
40	68	"
60	85.8	"
73	100	"

$SbCl_3$ + Chlorbenzene.

t°.	Gms $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−45.2 †	0	C_6H_5Cl
−47 *	4.3	" +1.1
−40	7	1.1
−30	11.1	"
−15	20.5	"
− 5	32.5	"
0 ‡	44.2	"
20	56	"
40	72.1	"
60	88.2	"
73	100	"

$SbCl_3$ + Fluorbenzene.

t°.	Gms $SbCl_3$ per 100 Gms Sat Sol.	Solid Phase
−39.2 †	0	C_6H_5F
−40.5 *	2.4	" + 1.1
−25	11	1.1
−15	17.3	"
−10	21.4	"
− 5	26.4	"
0	34.1	"
+ 5.5 ‡	45.8	1.1+$SbCl_3$
15	53.6	$SbCl_3$
25	61.6	"
45	77.7	"
65	93.8	"

$SbCl_3$ + Iodobenzene.

t°.	Gms $SbCl_3$ per 100 Gms Sat Sol	Solid Phase.
−28.6 †	0	C_6H_5I
−35	12.8	"
−45 *	29.8	" +1.1
−34.5	11.7	1.1, unstable
−15	26.4	" "
− 3	49.1	" "
−35	32.5	1.1+$SbCl_3$
−15	38.9	$SbCl_3$
+ 5	46.4	"
25	56	"
45	69.6	"
65	88.8	"

$SbCl_3$ + Nitrobenzene.

t°.	Gms $SbCl_3$ per 100 Gms Sat Sol	Solid Phase.
6 †	0	$C_6H_5NO_2$
− 2	20.4	"
−10	32	"
−16.5 *	38	" +1.1
−10.5	44	1.1
− 7.5	50	"
− 6 †	64.8	"
− 6.5 *	67.5	1.1+$SbCl_3$
+ 5	69.6	$SbCl_3$
35	78.7	"
55	87.4	"
70	96.6	"

$SbCl_3$ + Ethylbenzene.

t°	Gms $SbCl_3$ per 100 Gms Sat Sol	Solid Phase
−93 †	0	$C_6H_5.C_2H_5$
−93.5 *	0.3	" +1.1
−70	0.6	1.1
−50	1.1	"
−30	2.5	"
−10	7	"
+10	18.8	"
30	44.4	"
39 †	68.1	"
35 *	77.4	1.1+2.1
37 †	81.1	2.1
36.8 *	81.8	2.1+$SbCl_3$
50	87.2	$SbCl_3$
70	98	"
. .	. . .	.
33	80.4	1.1+$SbCl_3$ (unstable)

$SbCl_3$ + Benzonitrile.

t°	Gms $SbCl_3$ per 100 Gms Sat Sol	Solid Phase
−13.2 †	0	C_6H_5CN
−16	10.2	"
−19 *	17.2	" +1.1
−10	21.9	1.1
0	28.5	"
10	38.7	"
15	47.4	"
20	62.6	"
21.5 †	68.7	"
20	72.4	"
15 *	78.9	"
25	81.6	"
45	87.6	"
65	95.6	"
73	100	"

$SbCl_3$ + Isoamylbenzene.

t°	Gms $SbCl_3$ per 100 Gms Sat Sol	Solid Phase.
−80	4	1.1
−60	11.7	"
−40	25.4	"
−33 ‡	32.7	1.1+2.1
−25	38.7	2.1
−15	47.2	"
− 5 ‡	56.8	2.1+$SbCl_3$
0	57.4	$SbCl_3$
20	63.3	"
40	72.6	"
60	87.1	"
70	97.3	"
. . .	. . .	.
−25	44.4	unstable 1.1
−21 ‡	54.9	" 1.1+$SbCl_3$
−10	56	" $SbCl_3$

* Eutec † m pt ‡ tr. pt.

1.1 = compound of equimolecular amounts of the two constituents in each case.
2.1 = compound of 2 molecules of $SbCl_3$ with 1 molecule of the other constituent.

RECIPROCAL SOLUBILITIES OF ANTIMONY TRICHLORIDE AND VARIOUS ORGANIC COMPOUNDS, DETERMINED BY THE "SYNTHETIC METHOD."

(Menschutkin, 1910-11.)

$SbCl_3$ + *m* Dinitrobenzene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
90*	0	*m* $C_6H_4(NO_2)_2$	20	72.8 unstable	1.1
80	18.6	"	15	76.2 "	"
70	31.3	"	10	78.6 "	"
60	40.7	"	5	80.8 "	"
50	48	"	0	82.7 "	"
40	53.6	"	−10	64.9 "	$SbCl_3$
30	58	"	+10	69 "	"
20	61.6 unstable	"	20	71.6 "	"
10	64.5 "	"	30	74.8	"
1†	66.8 "	" +$SbCl_3$	40	78.7	"
−11	68.8 "	"	50	83.5	"
+27.5	52.5 "	1.1	60	89	"
28.5*	58.2	"	70	96.4	"
27.5	63	"	73	100	"
25	67.5	"			

$SbCl_3$ + Propylbenzene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−70	0.6	2.1
−30	10.1	"
−10	26.6	"
0	40.4	"
7	57.5	"
8.5‡	68.2	" +$SbCl_3$
20	71.4	$SbCl_3$
40	78.5	"
65	92.5	"
−70	1.5	1.1 unstable
−30	16	" "
−5	48.2	" "
+1.5*	65.3	" "
1†	66.3	" +$SbCl_3$ "
10	68.6	$SbCl_3$ "

$SbCl_3$ + *p* Dibrombenzene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.
88*	0
85	5.7
80	15.4
70	35
60	52.8
55	59
40.5†	64
65	71.8
60	79.3
70	95

$SbCl_3$ + *p* Dichlorbenzene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.
54.5*	0
50	14
45	30
40	48
39.5†	50.5
45	59.5
50	67.8
55	75.7
60	83
70	96.2

$SbCl_3$ + Cyclohexane.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	
6.4*	0.0	
6†	0.2	
20	1.2	
40	4.2	
60	9.7	
Two liquid layers formed		
70	13.7	97
80	19.5	96.1
100	32.3	92.7
120	57.1	83.2
124	58.9	76.7
125.5§	68	

$SbCl_3$ + *p* Cymene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−75*	0	*p* $C_6H_4CH_3C_3H_7$
−76.5†	2	" +1.1
−50	7	1.1
−30	15	"
−10	30	"
−3.5‡	41	1.1+2.1
10	46.1	2.1
30	60	"
40‡	76.4	2.1+$SbCl_3$
50	81.2	"
60	87	"
70	95.6	"

$SbCl_3$ + Pseudocymene.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
−57.4*	0	$C_6H_3(CH_3)_3$ 1, 2, 4
−60†	18.6	" +1.1
−45	23.6	1.1
−25	33.3	"
−10	45	"
−5‡	50.7	" +2.1
+15	55.8	2.1
35	62.2	"
50	69.7	"
56*	79.2	"
51†	87.5	2.1+$SbCl_3$
65	93.9	$SbCl_3$

$SbCl_3$ + Diphenyl.

t°.	Gms. $SbCl_3$ per 100 Gms. Sat. Sol.	Solid Phase.
70.5*	0	$C_6H_5.C_6H_5$
65	14	"
55	33.4	"
50†	40	" +2.1
55	45.2	2.1
60	51.4	"
70	70.7	"
71*	71.6	"
65	85.5	"
57†	88.9	2.1+$SbCl_3$
65	93.1	$SbCl_3$
70	97	"

* m. pt. † Eutec. ‡ tr. pt. § crit. t.

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Reciprocal Solubilities of Antimony Trichloride and Various Organic Compounds, Determined by the "Synthetic Method."

(Menschutkin, 1910–11)

$SbCl_3$ + Mesitylene.

t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol	Solid Phase
−54.4*	0	$C_6H_3(CH_3)_3$ 1, 3, 5
−55.6	1.5	" +1.1
−40	3	1.1
−20	7	"
0	14.2	"
10	20.3	"
30	39.3	"
38†	51.4	" +2.1
65	65.4	2.1
75.5*	79.2	"
70	87	"
58.5	92.4	" +$SbCl_3$
63	94	$SbCl_3$
70	98	"

$SbCl_3$ + Diphenyl Methane.

t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol	Solid Phase
26*	0	$CH_2(C_6H_5)_2$
22.5‡	7.9	" +2.1
40	15.1	2.1
60	26	"
70	33	"
80	41.6	"
90	52.7	"
95	59.8	"
100*	72.9	"
95	82.2	"
90	86.7	"
80	91.5	"
67‡	95.7	2.1+$SbCl_3$
70	97	$SbCl_3$

$SbCl_3$ + Triphenyl Methane.

t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol	Solid Phase.
92*	0	$CH(C_6H_5)_3$
85	11.8	"
80	19.3	"
70	32	"
60	42.4	"
50	49.6	"
49†	50	" +1.1
45	62.8	1.1
40	68.3	"
35‡	72	1.1+$SbCl_3$
45	76.6	$SbCl_3$
55	82.4	"
65	90.6	"
70	96.1	"

$SbCl_3$ + Naphthalene.

t°.	Gms $SbCl_3$ per 100 Gms. Sat. Sol	Solid Phase.
79.4*	0	$C_{10}H_8$
75	15.2	"
65	35	"
59‡	42.8	" +2.1
65	48.4	2.1
75	58.8	"
80	65	"
86*	78	"
80	88.7	"
70	93	"
65‡	94	2.1+$SbCl_3$
70	97.2	$SbCl_3$

$SbCl_3$ + α Chlornaphthalene.

t°	Gms $SbCl_3$ per 100 Gms Sat. Sol	Solid Phase.
−17*	0	α $C_{10}H_7Cl$
−21‡	8.1	" +2.1
0	14.4	2.1
10	18.7	"
20	24.6	"
30	33.5	"
40	47.7	"
45	61.5	"
46*	73.6	"
45.5‡	75	2.1+$SbCl_3$
55	82.2	$SbCl_3$
70	96.5	"

$SbCl_3$ + β Chlornaphthalene.

t°	Gms $SbCl_3$ per 100 Gms Sat. Sol	Solid Phase
56	0	β $C_{10}H_7Cl$
50	16.6	"
45	27.2	"
40	35.4	"
30	47.3	"
25‡	52.3	" +1.1
29.5*	58.2	1.1
28‡	64	1.1+$SbCl_3$
35	68.3	$SbCl_3$
45	75.3	"
60	87.5	"
73	100	"

$SbCl_3$ + α Bromnaphthalene.

t°	Gms $SbCl_3$ per 100 Gms. Sat. Sol	Solid Phase
3*	0	α $C_{10}H_7Br$
−1‡	8.3	" +1.1
10	12.8	1.1
25	24	"
33	38.5	"
34.5*	52.4	"
33	62.1	"
31.5‡	64.7	1.1+$SbCl_3$
40	69.7	$SbCl_3$
50	76.2	"
60	84.5	"
70	94.8	"

$SbCl_3$ + α Nitronaphthalene.

t°	Gms $SbCl_3$ per 100 Gms Sat. Sol	Solid Phase
57*	0	α $C_{10}H_7NO_2$
50	13.6	"
40	27.3	"
30‡	35.8	" +1.1
35	43.2	1.1
37.5	49.3	"
39*	56.7	"
37.5	64.9	"
34.5‡	72.8	1.1+$SbCl_3$
45	78	$SbCl_3$
60	87.4	"
70	96.6	"

* m pt. † tr. pt. ‡ Eutec

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2.1 = compound of 2 molecules of $SbCl_3$ with 1 molecule of the other constituent.

RECIPROCAL SOLUBILITIES OF ANTIMONY TRICHLORIDE AND VARIOUS ORGANIC COMPOUNDS, DETERMINED BY THE "SYNTHETIC METHOD."

(Menschutkin, 1910-12.)

SbCl₃ + Phenol.

t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.	Solid Phase.
41 *	0	C_6H_5OH
35	16.2	"
30	25.6	"
20	38.7	"
10	48	"
5 †	52	" + 2.1
15	58.6	2.1
30	70.6	"
37 *	83	"
36.5 †	83.7	2.1 + $SbCl_3$
55	90.6	$SbCl_3$
70	98.2	"

SbCl₃ + Phenetol.

t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.	Solid Phase.
−28.6 *	0	$C_6H_5OC_2H_5$
−29 †	1.4	" + 1.1
−20	4.5	1.1
−10	8.1	"
+10	18.2	"
20	27.4	"
30	39.4	"
40	58	"
42.2 *	65	"
35 †	77.8	"
50	86.8	"
70	97.1	"

SbCl₃ + Toluene.

t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.	Solid Phase.
−93 *	0	$C_6H_5CH_3$
−94 †	1.1	" + 1.1
−70	3.1	1.1
−30	15.8	"
0	41.5	"
11 ‡	57.8	" + 2.1
20	62.8	2.1
40	78	"
42.5 *	83.1	"
40 †	85.8	2.1 + $SbCl_3$
50	89	$SbCl_3$
70	97.8	"

SbCl₃ + *o* Chlortoluene.

t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.	Solid Phase.
−36.2 *	0	*o* $ClC_6H_4CH_3$
−37.5 †	6.9	" + 1.1
−20	18.3	1.1
−10	29.2	"
−5	37.1	"
−0.5 ‡	47.9	1.1 + $SbCl_3$
+10	53.1	$SbCl_3$
20	58.2	"
30	64.6	"
40	71.8	"
60	88.4	"
73	100	"

SbCl₃ + *m* Chlortoluene.

t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.	Solid Phase.
−47.8 *	0	*m* $ClC_6H_4CH_3$
−49 †	6.9	" + 1.1
−40	12.3	1.1
−30	20.1	"
−20	31	"
−14 ‡	40	1.1 + $SbCl_3$
0	46.1	$SbCl_3$
10	51.6	"
20	57.4	"
40	72.8	"
60	89.1	"
73	100	"

SbCl₃ + *p* Chlortoluene.

t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.	Solid Phase.
6.2 *	0	*p* $ClC_6H_4CH_3$
3	12.7	"
0	23.5	"
−3	32.2	"
−7.5 †	43.8	" + $SbCl_3$
0	47.2	$SbCl_3$
10	52.2	"
30	64.8	"
40	72.3	"
50	80.2	"
60	88.8	"
70	97.4	"

SbCl₃ + *o* Nitrotoluene.

t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.	Solid Phase.
−8.5 *	0	*o* $NO_2C_6H_4CH_3$
−13.5	11.3	"
−18.5 †	18.5	" + 1.1
−10	21.3	1.1
+10	31.1	"
20	39	"
30	50	"
34.5 *	62.3	"
33	68	"
27.5 †	74.6	" + $SbCl_3$
40	79.1	$SbCl_3$
50	84.5	"
70	97.5	"

SbCl₃ + *m* Nitrotoluene.

t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.	Solid Phase.
16 *	0	*m* $NO_2C_6H_4CH_3$
10	15	"
0	30.7	"
−10	39.2	"
−20	42.8	"
crystallization not obtained here		
0	67.2	$SbCl_3$
20	72.5	"
30	76.3	"
40	80.8	"
50	86	"
60	91.6	"
73	100	"

SbCl₃ + *p* Nitrotoluene.

t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.	Solid Phase.
52.5 *	0	*p* $NO_2C_6H_4CH_3$
45	18.5	"
35	33.6	"
30	38.8	"
20	46	"
7.5 †	52	" + 1.1
7.5 *	62.3	1.1
5	66.1	"
3 †	68.5	1.1 + $SbCl_3$
10	70	$SbCl_3$
30	75.5	"
50	85	"
70	97.5	"

* m. pt. † Eutec. ‡ tr. pt.

1.1 = compound of equimolecular amounts of the two constituents in each case.

2.1 = compound of 2 molecules of $SbCl_3$ with 1 molecule of the other constituent.

Reciprocal Solubilities of Antimony Trichloride and Various Organic Compounds, Determined by the "Synthetic Method."

(Menschutkin, 1910)

$SbCl_3$ + *o* Xylene.			$SbCl_3$ + *m* Xylene.			$SbCl_3$ + *p* Xylene.		
t°.	Gms $SbCl_3$ per 100 Gms Sat Sol	Solid Phase	t°	Gms $SbCl_3$ per 100 Gms Sat. Sol.	Solid Phase	t°.	Gms $SbCl_3$ per 100 Gms Sat. Sol.	Solid Phase.
−29	0	*o* $C_6H_4(CH_3)_2$	−57*	0	*m* $C_6H_4(CH_3)_2$	14*	0	*p* $C_6H_4(CH_3)_2$
−35†	14	" +1.1	−60.5†	7.5	" +1.1	11.7†	11.7	" +1.1
−30	17.5	1.1	−45	15.8	1.1	20	17.5	1.1
−20	24.8	"	−25	29	"	40	37.3	"
−10	33.4	"	−5	46.2	"	50	52.3	"
0	43.4	"	−2‡	49.8	" +2.1	55‡	62.7	" +2.1
10	55	"	5	53.1	2.1	60	66.1	2.1
19.5*	68.1	"	15	58.7	"	70*	81	"
25	71.3	2.1	25	65.7	"	65	88.1	"
30	75.7	"	33	73.8	"	58†	92	" +$SbCl_3$
33.5*	81	"	38*	81	"	69	97.2	$SbCl_3$
31.5†	82.5	2.1+$SbCl_3$	36.5†	83.7	2.1+$SbCl_3$	. .		
50	88	$SbCl_3$	50	87.7	$SbCl_3$	10	20.7	*p* $C_6H_4(CH_3)_2$ unstable
60	92.4	"	60	91.5	"	7†	32.8	" +2.1 "
71	98.5		70	97.2	"	35	50.3	2.1 "
						55	62.7	" "

* m pt. † Eutec. ‡ tr pt

1.1 = compound of equimolecular amounts of the two constituents in each case.
2.1 = compound of 2 molecules of $SbCl_3$ with 1 molecule of the other constituent.

Distribution of Antimony Tri and Pentachlorides between Aqueous HCl and Ether at Room Temperature

(Mylius, 1911)

When 1 gm. of antimony as $SbCl_3$ or as $SbCl_5$ is dissolved in 100 cc. of aq. HCl of the following strengths and the solution shaken with 100 cc. of ether, an amount of metal, depending upon the concentration of the aq. acid solution, enters the ethereal layer.

With 1% $SbCl_3$ Solution.		With 1% $SbCl_5$ Solution.	
Per cent Conc. of HCl.	Per cent of Total Sb in Ether Layer.	Per cent Conc of HCl	Per cent of Total Sb in Ether Layer.
20	6	20	81
15	13	15	22
10	22	10	6
5	8	5	2.5
1	0.3	1	trace

Solubility data determined by the freezing-point method (see footnote, p. 1) are given for mixtures of antimony trichloride and each of the following compounds: azobenzene, benzil, *s* diphenylethane, and stilbene (Van Stone, 1914); benzene, naphthalene, diphenylmethane and triphenylmethane (Kurnakov, Krotkov and Oksman, 1915); $SbBr_3$, SbI_3, and $SbBr_3$ + SbI_3 (Bernadis, 1912); $SbCl_5$ (Aten, 1909).

ANTIMONY PentaCHLORIDE $SbCl_5$.

Data for the freezing-points of mixtures of antimony pentachloride and antimony pentafluoride are given by Ruff (1909).

ANTIMONY TriFLUORIDE SbF_3.

SOLUBILITY IN WATER.

(Rosenheim and Grunbaum, 1909.)

t°.	Gms SbF_3 per 100 Gms Water.	Gms SbF_3 per 100 Gms Sat. Solution.
0	384.7	79.4
20	444.7	81.6
22.5	452.8	81.9
25	492.4	83.1
30	563.6	84.9

SOLUBILITY IN AQUEOUS SOLUTIONS OF SALTS AND OF HYDROFLUORIC ACID AT 0°.

Normality of Aq. Salt Solution.	Gms SbF_3 per 100 Gms H_2O present in Aq. Solutions of: KCl.	KBr.	KNO_3.	K_2SO_4.	$K_2C_2O_4$.	$(NH_4)_2C_2O_4$.	$K_2C_4H_4O_6$.	HF.
1	461.8	448.7	458.2	419.9	465.7	...	461.4	432.5
0.5	448.3	450	451.9	408.5	481.2	431.9	430.5	404
0.25	431.9	455.6	418.3	406.6	451.3	442.3	430.8	.
0.125	407.3	417.2	401.4	...	405.2	433.3	435.2	*479.4

* (2 n HF.)

Celluloid flasks were used and all measuring apparatus provided with HF resistant coating. The SbF_3 was prepared in the form of rhombic transparent crystals from Sb_2O_3 and HF.

ANTIMONY TriIODIDE SbI_3.

SOLUBILITY IN METHYLENE IODIDE AT 12°.

(Retgers, 1893.)

100 parts CH_2I_2 dissolve 11.3 parts SbI_3. Sp. Gr. of solution = 3.453.

SOLUBILITY DATA DETERMINED BY THE FREEZING-POINT METHOD ARE GIVEN FOR MIXTURES OF:

Antimony triiodide and arsenic triiodide. (Quercigh, 1912; Jaeger and Dornbosch, 1912; Vasilev, 1912.)
" " " phosphorus triiodide. (Jaeger and Dornbosch, 1912.)
" " " iodine. (Quercigh, 1912.)

ANTIMONY TriOXIDE Sb_2O_3

Freezing-point data are given for mixtures of antimony trioxide and antimony trisulfide. (Quercigh, 1912.)

ANTIMONY TriPHENYL $Sb(C_6H_5)_3$

Freezing-point data are given for mixtures of antimony triphenyl and mercury diphenyl and for antimony triphenyl and tin tetraphenyl. (Cambi, 1912.)

ANTIMONY SELENIDES $SbSe$, Sb_2Se.

Freezing-point data for $SbSe + Ag_2Se$ and $Sb_2Se + AgSe$. (Pélabon, 1908.)

ANTIMONY TriSULPHIDE Sb_2S_3

1000 cc. water dissolve 0.00175 gm. Sb_2S_3 at 18°. (Weigel, 1907.)

SOLUBILITY DATA DETERMINED BY THE FREEZING-POINT METHOD ARE GIVEN FOR MIXTURES OF:

Antimony trisulphide and cuprous sulfide. (Parravano and Cesaris, 1912.)
" " " stannous sulfide " "
" " " lead sulfide (Jaeger and Van Klooster, 1912; Pélabon, 1913.)
" " " silver sulfide. (Jaeger and Van Klooster, 1912.)

ANTIMONY Potassium **TARTRATE** $C_2H_2(OH)_2(COOK)(COOSbO).\frac{1}{2}H_2O$.

100 gms. water dissolve 5.9 gms. salt at room temp. (Squire and Caines, 1905)
" " " 6.9 " " " 25°. (S and S, 1903)
" " " 8 " " " 21°. (Aschan, 1913)
" 95% HCOOH dissolve 82.7 gms. salt at 20.8°. (Aschan, 1913)
" glycerol dissolve 5.5 gms. salt at 15.5°.

SOLUBILITY OF ANTIMONY POTASSIUM TARTRATE IN AQ. ALCOHOL SOLUTIONS AT 25°.
(Seidell, 1910)

Wt Per cent C_2H_5OH in Solvent	d_{25} of Sat Sol	Gms $C_4H_4O_6$ KSbO $\frac{1}{2}H_2O$ per 100 Gms Sat Sol	Wt Per cent C_2H_5OH in Solvent.	d_{25} of Sat Sol	Gms $C_4H_4O_6$ KSbO $\frac{1}{2}H_2O$ per 100 Gms Sat Sol.
0	1.052	7 85	40	0 935	0.38
5	1 025	5 50	50	0 913	0 23
10	1 007	3 92	60	0 890	0 12
20	0 980	1 92	70	0 866	0 06
30	0 958	0 84	100	0 788	trace

ANTIPYRINE $C_{11}H_{12}N_2O$

100 gms. water dissolve 80 gms. $C_{11}H_{12}N_2O$ at 15°. (Greenish and Smith, '03)
" " " 100 " " 25°. (U S P)
" alcohol " 100 " " " "
" 90% alcohol " 75 2 " " " "
" chloroform " 100 " " " "
" ether " 1 3 " " " (Enell, 1899)
" pyridine " 38 0 " " at 20-25°. (Dehn, 1917)
" 50% aq pyridine " 79.61 " " " "

THE SOLIDIFICATION POINTS OF MIXTURES OF ANTIPYRINE AND CHLORAL HYDRATE
(Tsakalatos, 1913)

t° of Solidification.	Gms $C_{11}H_{12}N_2O$ per 100 Gms Mixture	Solid Phase	t° of Solidification.	Gms $C_{11}H_{12}N_2O$ per 100 Gms. Mixture	Solid Phase.
108.9	100	$C_{11}H_{12}N_2O$	60	40.9	1 2
90	86 1	"	61.8 m. pt.	36 7	"
70	73	"	57	30.1	"
50.5 Eutec.	64 2	"+1 1	50	26 1	"
60	56 8	1 1	40	20 2	"
62 3 m. pt.	53.2	"	33 8 Eutec.	16 5	1 2+CCl_3 COH H_2O
60	50 3	"	40	6	CCl_3 COH H_2O
56 Eutec.	47 2	"+1 2	51.6	0	"

1.1 = $C_{11}H_{12}N_2O$ $CCl_3COH.H_2O$ (Hypnal).
1.2 = $C_{11}H_{12}N_2O.2(CCl_3.COH.H_2O)$ (Bihypnal).

THE SOLIDIFICATION POINTS (Solubility, see footnote, p. 1), OF MIXTURES OF ANTIPYRINE AND SALOL.
(Bellucci, 1912, 1913)

Initial t° of Solidification.	Gms $C_{11}H_{12}N_2O$ per 100 Gms. Mixture	Initial t° of Solidification.	Gms $C_{11}H_{12}N_2O$ per 100 Gms. Mixture.
112.6	100	65	40
104.5	90	53	30
98	80	30 Eutec.	17
91	70	34	20
83	60	35	10
75	50	42	0

APOMORPHINE HYDROCHLORIDE $C_{17}H_{17}NO_2.HCl$.

100 gms. water dissolve 1.7 gms. salt at 15° and 2 gms. at 25°.
100 gms. 90% alcohol dissolve 2 gms. salt at 25°.

(Dott, 1906, Squires and Caines, 1905.)

ARACHIDIC ACID $C_{20}H_{40}O_2$.

SOLUBILITY DATA DETERMINED BY THE FREEZING-POINT METHOD ARE GIVEN BY MEYER, BROD AND SOYKA (1913), FOR MIXTURES OF:

Arachidic and Stearic Acids.
" " Palmitic Acids
" " Lignoceric Acids.

ARBUTIN $C_{12}H_{16}O_7.\frac{1}{2}H_2O$.

100 gms. trichlorethylene dissolve 0.011 gm. arbutin at 15°.

(Wester and Bruins, 1914.)

ARGON, A.

SOLUBILITY IN WATER.
(Estreicher—Z. physik. Chem. 31, 184, '99.)

t°.	Cor. Bar Pressure.	Vol H_2O.	Vol Absorbed Argon.	Absorption Coefficients* a.	Absorption Coefficients* l	Solubility q.
0	...	...	.	...	0.0578	0.0102
1	764.9	77.40	4.34	0.0561	0.0561	0.0099
5	765.0	77.39	3.92	0.0507	0.0508	0.0090
10	765.3	77.41	3.49	0.0450	0.0453	0.0079
15	762.4	77.46	3.13	0.0404	0.0410	0.0072
20	757.6	77.53	2.86	0.0369	0.0379	0.0066
25	766.7	77.62	2.64	0.0339	0.0347	0.0060
30	760.6	77.73	2.43	0.0312	0.0326	0.0056
35	757.1	77.86	2.24	0.0288	0.0305	0.0052
40	758.3	77.99	2.07	0.0265	0.0286	0.0048
45	756.4	78.15	1.92	0.0246	0.0273	0.0045
50	747.6	78.31	1.73	0.0221	0.0257	0.0041

a = under barometric pressure minus tension of H_2O vapor
l = under 760 mm. pressure
q = grams argon per 100 g. H_2O when total pressure is equal to 760 mm.

* See Acetylene, page 16.

SOLUBILITY OF ARGON AND WATER.
(von Antropoff, 1909–10.)

t°.	Coef. of Absorption.
0	0.0561
10	0.0438
20	0.0379
30	0.0348
40	0.0338
50	0.0343

The coef. of absorption adopted for these results is that of Bunsen as modified by Kuenen. The modification consists in substituting unit of mass in place of unit of volume of water in the formula.

Data for the solubility of argon in water and in sea water, together with a critical discussion of the literature, are given by Coste (1917).

Data for the solubility and diffusion of argon in solid and liquid metals are given by Sieverts and Bergner (1912).

ARSENIC As.

Data for the fusion-points of mixtures of arsenic and iodine are given by Jaeger and Doornbosch (1912).

MetaARSENIC ACID AsO_2H.

DISTRIBUTION AT 25° BETWEEN:
(Auerbach, 1903)

H₂O and Amyl Alcohol. Gms AsO_2H per 1000 cc Aq Layer	Alcoholic Layer	Sat. Aq. H_3BO_3 Solution and Amyl Alcohol. Gms AsO_2H per 1000 cc Aq Layer	Alcoholic Layer
4.82	0.90	9.28	1.75
9.63	1.75	18.74	3.47
18.44	3.50		

ARSENIC TriBROMIDE and TriIODIDE $AsBr_3$ and AsI_3.

100 gms. H_2O dissolve about 6 gms AsI_3 at 25°. (U. S. P.)
100 gms. carbon disulfide dissolved about 5.2 gms. AsI_3. (Squires.)
100 gms. methylene iodide, CH_2I_2, dissolve 17.4 gms. AsI_3 at 12°, *d* of sat solution = 3.449. (Retgers, 1893.)

SOLUBILITY DATA DETERMINED BY THE FREEZING-POINT METHOD ARE GIVEN FOR MIXTURES OF:

Arsenic tribromide and naphthalene. (Pushin and Kriger, 1914.)
" " " phosphorus triiodide. (Jaeger and Doornbosch, 1912.)
" triiodide and iodine. (Quercigh, 1912.)

ARSENIC TriCHLORIDE $AsCl_3$.

When 1.0 gm of arsenic as the trichloride is dissolved in 100 cc of aq HCl and the solution shaken with 100 cc of ether the following percentages of the metal enter the ethereal layer, with 20% HCl, 68%; 15% HCl, 37%, 10% HCl, 7%; 5% HCl, 0.7% and with 1% HCl, 0.2% of the arsenic. (Mylius, 1911.)

ARSENIC TRIOXIDE As_2O_3

SOLUBILITY OF THE:

Crystallized Modification. In Water.

t°.	Gms As_2O_3 per 100 cc Sat Solution.
2	1.201
15	1.657
25	2.038
39.8	2.930
b. pt.	6.+

(Bruner and St. Tolloczko — Z. anorg. Chem. 37, 456, '03; Chodounsky — Listy Chem. 13, 114, '88.)

Amorphous Modification. In Water.

t°.	Gms As_2O_3 per 100 cc H_2O.
ord. temp.	3.7
b. pt.	11.86

In Alcohol, Ether and CS_2.

	G. As_2O_3 per 100 g Solvent.
Alcohol	0.446
Ether	0.454
CS_2	0.001

(Winkler — J. pr. Chem. [2] 31, 347, '85.)

SOLUBILITY OF ARSENIC TRIOXIDE IN AQUEOUS SOLUTIONS OF AMMONIA AT 30° (INTERPOLATED FROM ORIGINAL RESULTS).
(Schreinemakers and deBaat, 1915.)

Gms per 100 Gms Sat Sol NH_3	As_2O_3	Solid Phase	Gms per 100 Gms Sat Sol NH_3	As_2O_3	Solid Phase.
0	2.3	As_2O_3	4	7.6	NH_4AsO_4
1	8.3	"	5	6.2	"
2	14.9	"	7	4.6	"
2.8	20.5	$As_2O_3+NH_4AsO_2$	10	3.1	"
3	13	NH_4AsO_4	13	2.4	"
3.5	9.1	"	14.3	2.2	"

SOLUBILITY OF ARSENIC TRIOXIDE IN WATER AND IN AQUEOUS SOLUTION OF HYDROCHLORIC ACID AT 15° (Interpolated from the original).

(Wood, 1908.)

Mols HCl per Liter	Gms. As_2O_3 per 100 cc. Solution.	Mols HCl per Liter	Gms. As_2O_3 per 100 cc. Solution.
0	1.495	6	3.8
0.46	1.5	7	7.5
2	1.2	8	12.5
4	1.3	9	17.7

SOLUBILITY OF ARSENIC TRIOXIDE IN AQUEOUS SALT SOLUTIONS.

(Schreinemakers and de Baat, 1917.)

In Aq. Ammonium Bromide at 30°.

Gms. per 100 Gms. Sat. Sol. As_2O_3	Gms. per 100 Gms. Sat. Sol. NH_4Br	Solid Phase
2.26	0	As_2O_3
2.25	0.339	" $+As_2O_3.NH_4Br$
0.679	4.37	$As_2O_3.NH_4Br$
0.518	7.18	"
0.386	13.31	"
0.303	20.14	"
0.237	31.69	"
0.154	41.34	"
0.190	45.66	" $+NH_4Br$
0	44.8	NH_4Br

In Aq. Sodium Bromide at 30°.

Gms. per 100 Gms. Sat. Sol. As_2O_3	Gms. per 100 Gms. Sat. Sol. $NaBr$	Solid Phase
2.19	5.57	As_2O_3
2.09	10.89	"
1.88	20.79	"
1.63	30.39	"
1.50	35.75	"
1.20	39.24	$(As_2O_3)_3NaBr$
0.953	43.64	"
0.852	45.99	"
0.719	50.25	" $+NaBr.2H_2O$
0	±49.5	$NaBr.2H_2O$

In Aq. Barium Bromide at 30°.

Gms. per 100 Gms. Sat. Sol. As_2O_3	Gms. per 100 Gms. Sat. Sol. $BaBr_2$	Solid Phase
2.09	9.41	As_2O_3
2.03	16.88	"
1.97	24.03	"
1.87	24.41	"
1.58	23.49	$(As_2O_3)_3BaBr_2$
0.757	29.09	"
0.678	33.08	"
0.464	38.19	"
0.322	43.02	"
0.277	50.03	" $+BaBr_2.2H_2O$
0	50.62	$BaBr_2.2H_2O$

In Aq. Barium Chloride at 30°.

Gms. per 100 Gms. Sat. Sol. As_2O_3	Gms. per 100 Gms. Sat. Sol. $BaCl_2$	Solid Phase
2.24	3.84	As_2O_3
2.20	8.72	"
2.19	8.86	"
2.15	10.34	"
1.09	9.55	$(As_2O_3)_2.BaCl_2$
1.12	13.62	"
0.905	16.03	"
0.737	20.06	"
0.608	23.87	"
0.506	26.54	" $+BaCl_2.2H_2O$
0	27.6	$BaCl_2.2H_2O$

In Aq. Calcium Bromide at 20°.

Gms. per 100 Gms. Sat. Sol. As_2O_3	Gms. per 100 Gms. Sat. Sol. $CaBr_2$	Solid Phase
1.58	9.65	As_2O_3
1.28	20.13	"
0.912	34.90	"
0.789	41	"
0.698	47.67	"
0.513	52.06	"
0.687	58.22	" $+CaBr_2.6H_2O$
0	58.20	$CaBr_2.6H_2O$

In Aq. Calcium Chloride at 19.5°-20°.

Gms. per 100 Gms. Sat. Sol. As_2O_3	Gms. per 100 Gms. Sat. Sol. $CaCl_2$	Solid Phase
1.78	0	As_2O_3
1.39	12.66	"
1.01	23.09	"
0.865	27.68	"
0.757	31.85	"
0.697	36.01	"
0.675	41.92	" $+CaCl_2.6H_2O$
0	42.7	$CaCl_2.6H_2O$

100 gms. 95% formic acid dissolve 0.02 gm. As_2O_3 at 19.8°. (Aschan, 1913.)

SOLUBILITY OF ARSENIC TRIOXIDE IN AQUEOUS SALT SOLUTIONS. (*Continued.*)

In Aq. Lithium Bromide at 30°.

Gms per 100 Gms Sat. Sol. As_2O_3.	Gms per 100 Gms Sat. Sol. LiBr	Solid Phase.
2.26	0	As_2O_3
1.69	11.68	"
1.20	23.23	"
0.734	35.54	"
0.534	37	" $+(As_2O_3)_2LiBr$
0.332	42.62	$(As_2O_3)_2LiBr$
0.281	43.87	"
0.198	46.75	"
0	59.62	$LiBr\,H_2O$

In Aq. Lithium Chloride at 30°.

Gms per 100 Gms Sat. Sol. As_2O_3	Gms per 100 Gms Sat. Sol. LiCl	Solid Phase
1.69	7.57	As_2O_3
1.15	15.30	"
0.77	22.67	"
0.54	29.04	"
0.43	35.37	"
0.39	41.13	"
0.385	43.01	"
0.41	45.12	" $+LiCl\,H_2O$
0	46.1	$LiCl\,H_2O$

In Aq. Potassium Bromide at 30°.

Gms per 100 Gms Sat. Sol. As_2O_3	Gms per 100 Gms Sat. Sol. KBr.	Solid Phase
2.25	0.336	As_2O_3+D
0.818	2.51	D
0.460	12.78	"
0.327	22.59	"
0.290	27.40	"
0.275	36.98	"
0.207	39.04	"
0.166	42.07	"+KBr
0	±41.3	KBr

D varies from $(As_2O_3)_2KBr$ to $(As_2O_3)_7(KBr)_4$.

In Aq. Potassium Iodide at 30°.

Gms per 100 Gms Sat. Sol. As_2O_3	Gms per 100 Gms Sat. Sol. KI	Solid Phase.
2.26	0	As_2O_3
0.772	1.19	$(As_2O_3)_2KI$
0.296	9.56	"
0.183	22.89	"
0.150	34.31	"
0.119	40.79	"
0.081	47.07	"
0.115	53.51	"
0.134	60.54	" +KI
0	61.5	KI

In Aq. Strontium Bromide at 30°.

Gms per 100 Gms Sat. Sol. As_2O_3	Gms per 100 Gms Sat. Sol. $SrBr_2$	Solid Phase
1.69	11.69	As_2O_3
1.74	22.09	"
1.48	31.98	"
1.25	41.91	"
1.07	46.87	"
0.991	48.91	" $+SrBr_2\,6H_2O$
0	49.11	$SrBr_2\,6H_2O$

In Aq. Strontium Chloride at 30°.

Gms per 100 Gms Sat. Sol. As_2O_3	Gms per 100 Gms Sat. Sol. $SrCl_2$	Solid Phase.
2.14	6.27	As_2O_3
1.92	13.67	"
1.67	21.29	"
1.46	27.46	"
1.28	34.03	"
1.23	36.16	" $+SrCl_2\,6H_2O$
0	37.5	$SrCl_2\,6H_2O$

ARSENIC PENTOXIDE As_2O_5.

SOLUBILITY IN WATER.

(Menzies and Potter, 1912.)

t°.	Gms As_2O_5 per 100 Gms Sat. Sol.	Solid Phase.	t°.	Gms As_2O_5 per 100 Gms Sat. Sol.	Solid Phase.
−5	10.6	Ice	−10	36.2	$As_2O_5\,4H_2O$
−10	15.6	"	0	37.3	"
−20	21.3	"	+10	38.3	"
−30	25.1	"	20	39.7	"
−40	27.8	"	29.5	41.4	" $+3As_2O_5\,5H_2O$
−50	29.9	"	40	41.6	$3As_2O_5\,5H_2O$
−59 Eutec.	31.7	Ice $+As_2O_5\,4H_2O$	60	42.2	"
−50	32.6	$As_2O_5\,4H_2O$	80	42.9	"
−40	33.5	"	100	43.4	"
−30	34.4	"	120	43.7	"
−20	35.4	"	140	44.5	"

100 gms. 95% HCOOH dissolve 7.6 gms. As_2O_5 at 19°. (Aschan, 1913.)

ARSENIOUS SULFIDE As_2S_3.

1000 cc. water dissolve 0.000517 gm. As_2S_3 at 18°. (Weigel, 1907)

Data for the fusion-points of mixtures of arsenious sulfide and silver sulfide are given by Jaeger and Van Klooster (1912).

ASPARAGINE $C_4H_8N_2O_3.H_2O$.

SOLUBILITY β-*l*-ASPARAGINE, $C_4H_8N_2O_3.H_2O$, AND OF β-*l*-ASPARAGINIC ACID, $C_4H_7NO_4$, IN WATER.

(Bresler — Z. physik. Chem. 47, 613, '04.)

β-*l*-Asparagine				β-*l*-Asparaginic Acid			
t°.	Gms. $C_4H_8N_2O_3.H_2O$ per 100 g H_2O.	t°.	Gms. $C_4H_8N_2O_3.H_2O$ per 100 g H_2O.	t°.	Gms. $C_4H_7NO_4$ per 100 g H_2O.	t°.	Gms. $C_4H_7NO_4$ per 100 g H_2O.
0.7	0.9546	55.5	10.650	0.2	0.2674	51.0	1.2740
7.9	1.4260	71.7	19.838	9.5	0.4042	63.5	1.8147
17.5	2.1400	87.0	36.564	16.4	0.5176	70.0	2.3500
28.0	3.1710	98.0	52.475	31.5	0.7514	80.5	3.2106
41.4	5.6500			40.0	0.9258	97.4	5.3746

100 gms. H_2O dissolve 2.4 gms. asparagine at 20°-25°. (Dehn, 1917.)
100 gms. pyridine dissolve 0.03 gm. asparagine at 20°-25°. "
100 gms. 50% aq. pyridine dissolve 0.15 gm. asparagine at 20°-25°. "
100 gms. trichlorethylene dissolve 0.018 gm. asparagine at 15°. (Wester & Bruins, 1914.)

Data for the solubility of asparaginic acid in aqueous salt solutions are given by Wurgler (1914).

ASPIRIN (Acetyl salicylic acid) $C_6H_4(OCH_3CO)COOH$.

100 gms. water dissolve 0.25 gm. aspirin at room temperature. (Squire and Caines, 1905.)
100 cc. 90% alcohol dissolve 20 gm. aspirin at room temperature. "

ATROPINE $C_{17}H_{23}NO_3$

SOLUBILITY OF ATROPINE, $C_{17}H_{23}NO_3$, AND OF ATROPINE SULFATE, $(C_{17}H_{23}NO_3)_2.SO_2(OH)_2$, IN WATER AND OTHER SOLVENTS.

(U. S. P., Muller, 1905.)

Solvent.	t°.	Gram Atropine per 100 Grams Solution.	Gram Atropine per 100 Grams Solvent (U. S. P.).	Grams Atropine Sulfate per 100 Grams Solvent (U. S. P.).
Water	25	1.782 (20°)	0.222 (0.13*)	263.1
Water	80		1.[illegible]	454.5
Alcohol	25	.	68.[illegible]	27
Alcohol	60		111.[illegible]	52.6
Ether	25	2.21 (20°)	6.[illegible]	0.047
Chloroform	25	68.03 (20°)	64[illegible]	0.161
Benzene	20	3.99		.
Carbon Tetrachloride	20	0.661	1.136† (1.76‡)	
Ethyl Acetate	20	3.88	...	.
Petroleum Ether	20	0.83	...	.
Glycerol	15	.	3	33
Aniline	20		34§	...
Diethylamine	20	.	67§	..
Pyridine	20	..	73§	...
Piperidine	20	...	114§	...
50% Aq. Glycerol + 3% H_3BO_3	..	10¶	...	...
Oil of Sesame	20	.	0.25*	...

* Zalai, 1910. † At 17°, Schindelmeiser, 1901. ‡ Gori, 1913. § Scholtz, 1912. ¶ Baroni and Borlinetto, 1911.

DISTRIBUTION OF ATROPINE BETWEEN WATER AND CHLOROFORM AT 25°.
(Seidell, 1910a)

Gms Atropine Added per 15 cc H_2O+15 cc $CHCl_3$	Gms Atropine Recovered per 15 cc. Aqueous Layer (a).	Chloroform Layer (b).	$\frac{b}{a}$.
0 005	0 0010	0 0057	5.7
0 025	0.0021	0 0256	12 2
0 125	0 0049	0.1246	25.4
0 625	0 0160	0.6267	39.1

ATROPINE METHYLBROMIDE $C_{17}H_{23}NO_3.CH_3Br$.

100 gms water dissolve 100 gms. of the salt at room temp. (Squires and Caines, 1905)
100 cc. 90% alcohol dissolve 10 gms. of the salt at room temp. " "

AZELAIC ACID $C_7H_{14}(COOH)_2$.

SOLUBILITY IN WATER.
(Lamouroux, 1899)

t°. =	0	15	20	35	50	65
Gms. $C_7H_{14}(COOH)_2$ per 100 cc. solution =	0 10	0.15	0.24	0.45	0.82	2 20

100 gms. 95% HCOOH dissolve 3.79 gms. azelaic acid at 19.4°. (Aschan, 1913)

DISTRIBUTION OF AZELAIC ACID BETWEEN WATER AND ETHER AT 25°.
(Chandler, 1908)

Gms $C_7H_{14}(COOH)_2$ per 1000 cc Aq Layer	Ether Layer	Gms $C_7H_{14}(COOH)_2$ per 1000 cc. Aq Layer.	Ether Layer.
0 06	0 47	0 40	5 83
0.10	1.10	0 50	7 40
0.20	2.71	0.58	8.65
0.30	4 26		

AZOBENZENE $C_6H_5.N_2.C_6H_5$.

SOLUBILITY OF AZOBENZENE IN SEVERAL BINARY MIXTURES.
(Timmermans, 1907)

Solvent, Binary Mixture of	t°.	Gms $(C_6H_5N)_2$ per 100 Gms Sat Sol.
34.9% Butyric Acid + 65.1% H_2O (= sat. sol. at 2.3°)	6 4	0 46
	10	0.55
	20	1.13
	30	1.92
	40 6	2 95
36% Triethylamine + 64% H_2O (= sat. sol. at 19.1°)	8 8	3.22
	11	2.57
	14	1 66
	17 4	0.54
36.5% Phenol + 63.5% H_2O (= sat. sol. at 65.3°)	69.3	0.43
	72 7	0.47
	80	1.47
	90	2.43
	100	3.45
71.4% Phenol + 28.6% H_2O (= sat. sol. at 20.6°)	23.9	0.52
	25.2	0.87
	40	4.45
	60	10 35
	72.6	133 40
46% Succinic Nitrile + 54% H_2O (= sat. sol. at 54°)	56.9	0.54

SOLUBILITY OF AZOBENZENE IN SEVERAL ALCOHOLS.
(Timofeiew, 1894.)

Solvent	t°.	Gms. $(C_6H_5N)_2$ per 100 Gms. Sat. Sol.	Solvent	t°.	Gms. $(C_6H_5N)_2$ per 100 Gms. Sat. Sol.
Methyl Alcohol	9.5	3.8	Ethyl Alcohol	10.5	5.88
" "	10.5	3.95	Propyl Alcohol	9.5	5.42
Ethyl Alcohol	9.5	5.29	" "	10.5	6.02

SOLUBILITY OF AZOBENZENES IN WATER AND IN PYRIDINE.
(Dehn, 1917.)

Solvent.	t°.	Gms. Each Compound (Determined Separately) per 100 Gms. Solvent. Azobenzene.	Diazoaminobenzene.	Dimethylaminoazobenzene.
Water	20-25	0.03	0.05	0.016
Pyridine	20-25	76.44	136.7	27.00
Aq. 50% Pyridine	20-25	16.78	67.7	4.51

Hydroxy**AZOBENZENE** $C_6H_5N : NC_6H_4OH$.

1000 cc. sat. solution in H_2O contain 0.0225 gm. $C_6H_5N : NC_6H_4OH$ at 25°.

1000 cc. sat. solution in H_2O sat. with C_6H_6 contain 0.0284 gm. $C_6H_5N : N.C_6H_4OH$ at 25°.

1000 cc. sat. solution in C_6H_6 sat. with H_2O contain 15.20 gms. $C_6H_5N : N.C_6H_4OH$ at 25°. (Farmer, 1901.)

Distribution results for hydroxyazobenzene between benzene and water gave: conc. in C_6H_6 ÷ conc. in H_2O = 539 at 25°. (Farmer, 1901.)

Amino**AZOBENZENE** $C_6H_5N : N.C_6H_4NH_2$.

Distribution results for amino azobenzene between benzene and water gave: conc. in C_6H_6 ÷ conc. in H_2O = 3,173 at 25°. (Farmer and Warth, 1904.)

AZOANISOL, AZOBENZENE, AZOPHENETOL, etc.

SOLUBILITY DATA, DETERMINED BY THE FREEZING-POINT METHOD (see footnote, p. 1), ARE GIVEN FOR THE FOLLOWING MIXTURES.

p Azoanisol
+ *p* Azoxyanisol (1)
" + *p* Azoanisolphenetol (1)
" + Methylpropylazophenol (1)
" + *p* Azophenetol (1)

p Azoxyanisol
+ *p* Azoanisolphenetol (1)
" + *p* Azoxyphenetol (3), (4)
" + Benzene (2)
" + Ethylene bromide (2)
" + Hydroquinone (5)
" + Benzophenone (5)
" + *p* Methoxycinnamic Acid (5)
" + Nitrobenzene (2)

p Azoanisolphenetol
" + Azophenetol (1)
" + *p* Dipropylazophenetol (1)

Azobenzene
+ Azoxybenzene (6)
" + *p* Azotoluene (7)
" + *p* Azonaphthalene (7)
" + Benzalaniline (7)

p Azobenzoic Acid Ethyl Ester
+ *p* Azoxybenzoic Acid Ethyl Ester (5)

Azobenzene
+ Benzeneazonapthalene (9)
" + Benzil (8)
" + Benzoin (8)
" + Benzylaniline (7), (9), (10), (11), (12)
" + Dibenzyl (7), (13), (14), (12)
" + Diphenyl (9)
" + *p* Dimethoxystilbene (7)
" + Hydrobenzoine (7)
" + Stilbene (7), (9)
" + Tolane (7)

Hydrazobenzene
+ Benzoin (8)

p Azophenetol
+ *p* Azoxyphenetol (1)
" + *p* Dipropylazophenetol (1)

p Azoxyphenetol
+ Cholesterylisobutyrate (4)
" + Cholesterylpropionate (4)
" + Cholesterylbenzoate (4)
" + *p* Methoxycinnamate (4)

p Azotoluene
+ Stilbene (7)

(1) Bogojawlausky and Winogrodow, 1907, (2) Bogojawlauski, Winogrodow and Bogolubow, 1906, (3) Rotinjanz and Rotarski, 1906, (4) Prins, 1909, (5) de Kock, 1904, (6) Hartley and Stewart, 1914; (7) Pascal and Normand, 1913, (8) Vanstone, 1913, (9) Beck, 1904, (10) Isaac (1910-11), (11) Jaeger, 1907, (12) Hasselblatt, 1913, (13) Garelli and Calzolari, 1899, (14) Bruni and Gorni, 1899.

AZOLITMINE $C_7H_7NO_4$.

100 gms. H_2O dissolve 39.5 gms. azolitmine at 20°–25°. (Dehn, 1917)
100 gms. pyridine dissolve 0.05 gm. azolitmine at 20–25°. "
100 gms. aq. 50% pyridine dissolve 0.12 gm. azolitmine at 20°–25°. "

AZOPHENETOL (*p*) $C_6H_5N_2.C_6H_4.OC_2H_5$.

SOLUBILITY IN 100 PER CENT ACETIC ACID.

(Dreyer and Rotarski — Chem Centr 76, II, 1016, '05)

t° =	89.2	91	93	95.6	97.2	99.6
Mols. per liter.	0.153	0.176	0.185	0.209	0.232	0.252

A break in the curve at 94.7° corresponds to the transition temperature of the α modification into the β modification.

BARIUM ACETATE $Ba(CH_3COO)_2$.

SOLUBILITY IN WATER.

(Walker and Fyffe, 1903, Krasnicki, 1887, gives incorrect results)

t°.	Gms. $Ba(CH_3COO)_2$ per 100 Gms Water	Solution	Solid Phase.	t°.	Gms. $Ba(CH_3COO)_2$ per 100 Gms Water	Solution	Solid Phase.
0.3	58.8	37.0	$Ba(C_2H_3O_2)_2.3H_2O$	40.5	79.0	44.1	$Ba(C_2H_3O_2)_2$
7.9	61.6	38.1	"	41.5	78.7	44.0	"
17.5	69.2	40.9	"	44.5	77.9	43.8	"
21.6	72.8	42.1	"	51.8	76.5	43.4	"
24.1	78.1	43.9	"	63.0	74.6	42.7	"
26.2	76.4	43.3	$Ba(C_2H_3O_2)_2.H_2O$	73.0	73.5	42.4	"
30.6	75.1	42.9	"	84.0	74.0	42.5	"
35.0	75.8	43.1	"	99.2	74.8	42.8	"
39.6	77.9	43.8	"				

Transition temperatures 24.7° and 41°.

100 cc. 97% ethyl alcohol dissolve 0.0723 gm. barium acetate at room temp. (Crowell, 1918)

SOLUBILITY OF BARIUM ACETATE IN AQUEOUS SOLUTIONS OF ACETIC ACID AT 25°.

(Iwaki, 1914)

Mols per 100 Mols Sat Sol CH_3COOH	$(CH_3COO)_2Ba$	Solid Phase	Mols per 100 Mols Sat Sol CH_3COOH	$(CH_3COO)_2Ba$	Solid Phase.
0	5.18	$(CH_3COO)_2Ba.3H_2O$	28.72	4.52	3.3.11
0.41	5.21	"	36.54	5.60	"
1.40	5.34	" +3.3.11	42.08	7.85	"
1.46	5.32	3.3.11	46.51	8.87	" +1.3
3.30	3.48	"	51.98	8.62	1.3
10.23	3.14	"	65.77	8.40	"
20.60	3.62	"	85.27	7.36	"

3.3.11 = $3(CH_3COO)_2Ba.3CH_3COOH.11H_2O$, 1.3 = $(CH_3COO)_2Ba.3CH_3COOH$.

BARIUM ARSENATE $Ba_3(AsO_4)_2$.

100 gms. H_2O dissolve 0.055 gm. $Ba_3(AsO_4)_2$; 100 gms. 5% NH_4Cl dissolve 0.195 gm., and 100 gms. 10% NH_4OH dissolve 0.003 gm. $Ba_3(AsO_4)_2$

(Field — J Ch Soc 11 6, 1859)

BARIUM BENZOATE $(C_6H_5COO)_2Ba.6H_2O$.

100 gms. sat. aqueous solution contain 4.3 gms. salt (anhydrous ?) at 15° and 10.1 gms. at 100°. (Tarugi and Checchi, 1901)

BARIUM BORATES.

SOLUBILITY IN AQUEOUS BORIC ACID SOLUTIONS AT 30°.

(Sborgi, 1913.)

Gms. per 100 Gms. Sat. Sol. B_2O_3	Gms. per 100 Gms. Sat. Sol. BaO	Solid Phase	Gms. per 100 Gms. Sat. Sol. B_2O_3	Gms. per 100 Gms. Sat. Sol. BaO	Solid Phase
3.6	0.04	H_3BO_3+1.3.7	0.3	0.23	1.3.7
3.4	0.04	1.3.7	0.3	0.31	1.3.7+1.1.4
2.5	0.04	"	0.2	0.8	1.1.4
2.0	0.04	"	0.2	1.2	"
1.0	0.05	"	0.24	4.8	"
0.5	0.09	"	0.26	5.8	1.14+$Ba(OH)_2$
0.4	0.12	"	0.08	5.3	$Ba(OH)_2$

1.3.7 = $BaO.3B_2O_3.7H_2O$ (Triborate); 1.1.4 = $BaO.B_2O_3.4H_2O$ (Metaborate). The original results were plotted and above figures read from curve.

BARIUM BROMATE $Ba(BrO_3)_2.H_2O$

SOLUBILITY IN WATER.

(Trautz and Anschutz, 1906; Rammelsberg, 1841.)

t°	Gms. $Ba(BrO_3)_2$ per 100 Gms. Solution.	t°.	Gms. $Ba(BrO_3)_2$ per 100 Gms. Solution.	t°	Gms. $Ba(BrO_3)_2$ per 100 Gms. Solution.
−0.034	0.28	30	0.95	70	2.922
0	0.286	40	1.31	80	3.521
+10	0.439	50	1.72	90	4.26
20	0.652	60	2.271	98.7	5.256
25	0.788			99.65	5.39

SOLUBILITY OF BARIUM BROMATE IN AQUEOUS SOLUTIONS OF SALTS AT 25°.

(Harkins, 1911.)

Conc. of Salt in Gms. Equivalents per Liter	Gms. $Ba(BrO_3)_2$ Dissolved per Liter in Aqueous Sol. of KNO_3	$Ba(NO_3)_2$	$KBrO_3$	$Mg(NO_3)_2$
0	7.93 (1.0038)	7.93	7.93	7.93
0.025	8.62 (1.0059)	7.22 (1.0059)	5.216 (1.0046)	
0.050	9.91 (1.0080)	6.83 (1.0083)	3.415 (1.0062)	
0.100	10.25 (1.0120)	6.415 (1.0132)	1.72 (1.0100)	8.196 (1.0114)
0.200		6.230 (1.0233)		

Figures in parentheses show densities of the sat. sols. at $\frac{25°}{4°}$.

BARIUM BROMIDE $BaBr_2.2H_2O$

SOLUBILITY IN WATER.

(Kremers — Pogg. Ann. 99, 47, '56; Etard — Ann. chim. phys. [7] 2, 540, '94.)

t°.	Gms. $BaBr_2$ per 100 Grams Water (Kremers.)	Solution (Kremers.)	Solution (Etard.)	t°.	Gms. $BaBr_2$ per 100 Grams Water (Kremers.)	Solution (Kremers.)	Solution (Etard.)
−20	..		45.0	40	114	53.2	51.5
0	98	49.5	47.5	50	118	54.1	52.5
10	101	50.2	48.5	60	123	55.1	53.5
20	104	51.0	49.5	70	128	56.1	54.5
25	106	51.4	50.0	80	135	57.4	55.5
30	109	52.1	50.6	100	149	60.0	57.8
				140		...	59.4

Sp. Gr. of saturated solution at 19.5° = 1.710.

Data for the system Barium Bromide + Barium Oxide + H_2O at 25° are given by Milikau (1916).

SOLUBILITY OF MIXTURES OF BARIUM BROMIDE AND BARIUM IODIDE IN WATER AT DIFFERENT TEMPERATURES.

(Etard.)

t°.	Grams per 100 Gms. Solution. BaBr₂.	BaI₂.	t°.	Grams per 100 Gms. Solution. BaBr₂.	BaI₂.
−16	4 8	58.4	170	11 0	67.4
+60	5 5	66 0	210	14 9	67.7
135	9 2	67 2	Both salts present in solid phase.		

SOLUBILITY OF BARIUM BROMIDE IN METHYL AND ETHYL ALCOHOLS.

(de Bruyn — Z. physik. Chem. 10, 783, '92; Richards — Z. anorg. Chem. 3, 455, '93; Rohland — *Ibid.* 15, 412, '97.)

t°.	Parts $BaBr_2$ per 100 parts Aq. C_2H_5OH of: 100%	97%.	87%.	Parts $BaBr_2.2H_2O$ per 100 parts of Aq. CH_3OH of: 100%.	93.5%.	50%.
15.0	..	0 48 ($BaBr_2.2H_2O$)	..	45 9	27.3	4 0
22 5	3		6	56 1	...	...

100 gms. sat. solution in methyl alcohol at the crit. temp. contain 0.4 gm. $BaBr_2$. (Centnerszwer, 1910.)

Data for the lowering of the melting point of $BaBr_2$ by BaF_2 and by $BaCl_2$ are given by Ruff and Plato (1903).

BARIUM PerBROMIDE $BaBr_4$.

Data for the formation of barium perbromide in aqueous solutions at 25° are given by Herz and Bulla (1911). See reference calcium perbromide, p. 189.

BARIUM BUTYRATE $Ba(C_4H_7O_2)_2 2H_2O$.

SOLUBILITY IN WATER.

(Deszathy — Monatsh. Chem. 14, 249, '93.)

t°.	Gms. $Ba(C_4H_7O_2)_2$ per 100 Gms. Water	Solution.	t°.	Gms. $Ba(C_4H_7O_2)_2$ per 100 Gms. Water	Solution.
0	37.42	27 24	50	36 44	26.77
10	36 65	26 82	60	37 68	27 36
20	36 12	26 55	70	39 58	28 36
30	35 85	26 38	80	42 13	29 64
40	35 82	26 37			

100 gms. 97% ethyl alcohol dissolve 0.17 gm. barium butyrate at ord. temp. (Crowell, 1918.)

BARIUM CAMPHORATE $BaC_{10}H_{14}O_4.4H_2O$.

SOLUBILITY OF BARIUM CAMPHORATE IN AQUEOUS SOLUTIONS OF CAMPHORIC ACID AT 16°-17°.

(Jungfleisch and Landrieu, 1914.)

Gms. per 100 Gms. Sat. Sol. Camphoric Acid.	Barium Camphorate.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. Camphoric Acid.	Barium Camphorate.	Solid Phase.
0.68	0.134	*d* Camphoric ac. + 1.3	0.48	22.71	1.3
0.84	0.150	"	0.45	32.19	"
0.693	0.20	1.3	0.50	37.22	"
0.38	2.59	"	0.51	40.99	1.3 + Ba Camphorate
0.44	11.10	"	0	42 59	Ba Camphorate

1.3 = Barium tetracamphorate, $C_{10}H_{14}O_4Ba.3C_{10}H_{16}O_4$.

BARIUM CAPROATE AND BARIUM ISO CAPROATE.

SOLUBILITY IN WATER

	(Kulisch, 1893.) Barium Caproate (Methyl 3 Pentan.) $Ba(CH_3CH_2CH(CH_3)CH_2COO)_2$			(Konig 1893.) Barium Iso Caproate (Methyl 2 Pentan.) $Ba(CH_3CH(CH_3)CH_2CH_2COO)_2$		
t°.	Gms $Ba(C_6H_{11}O_2)_2$ per 100 Gms Water	Gms $Ba(C_6H_{11}O_2)_2$ per 100 Gms Solution	Solid Phase	Gms $Ba(C_6H_{11}O_2)_2$ per 100 Gms Water.	Gms $Ba(C_6H_{11}O_2)_2$ per 100 Gms Solution	Solid Phase
0	11.71	10.40	$Ba(C_6H_{11}O_2)_2.3\frac{1}{2}H_2O$	14.31	12.54	$Ba(C_6H_{11}O_2)_2.4H_2O$
10	8.38	7.73	"	13.33	11.77	"
20	6.89	6.45	"	12.67	11.26	"
30	5.87	5.55	"	12.37	11.01	"
40	5.79	5.47	"	12.42	11.05	"
50	6.63	6.21	"	12.83	11.38	"
60	8.39	7.74	"	13.03	11.09	"
70	11.09	9.98	"	14.68	12.80	"
80	14.71	12.82	"	16.24	13.97	"
90	19.28	16.16	"	17.95	15.23	"

BARIUM CARBONATE $BaCO_3$.

SOLUBILITY IN WATER

(Holleman, Kohlrausch and Rose, 1893.)

Electrolytic conductivity method used.

1 liter H_2O dissolves 0.016 gm. $BaCO_3$ at 8.8°, 0.022 gm. at 18°, and 0.024 gm. at 24.2°.

SOLUBILITY OF BARIUM CARBONATE IN WATER CONTAINING CO_2.

The average of several determinations at about 10°, by Bineau, Lassaigne, Fourcroy and Bergmann is 1.10 gms. $BaCO_3$ per liter water. Wagner (Z. anal. Ch. **6**, 167, '67) gives 7.25 gms. $BaCO_3$ per liter of water saturated with CO_2 at 4–6 atmospheres pressure.

Eleven determinations by McCoy and Smith (1911), of the solubility of barium carbonate at 25° in water in contact with pressures of CO_2 varying from 0.2 to 30 atmospheres, showed that a maximum solubility is reached at 22 atmospheres (see also calcium carbonate, p. 192), at which point the saturated solution contains 0.727 mols. = 45.1 gms. H_2CO_3 per liter and 0.028 mols. = 7.3 gms. $Ca(HCO_3)_2$ per liter. The equilibrium constant is $k = 2.24 \times 10^{-2}$ and the solubility product $Ba \times CO_3 = k_3 = 8.1 \times 10^{-9}$.

SOLUBILITY OF BARIUM CARBONATE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AT 30°.

(Kernot, d'Agostino and Pellegrino, 1908.)

Gms. per 1000 cc. H_2O $BaCO_3$	Gms. per 1000 cc. H_2O NH_4Cl	Solid Phase.	Gms. per 1000 cc. H_2O $BaCO_3$	Gms. per 1000 cc. H_2O NH_4Cl	Solid Phase.
0.035	0	$BaCO_3$	2.245	335.70	$BaCO_3$
0.521	8.099	"	2.706	358.66	"
1.333	64.536	"	2.630	418.33	NH_4Cl
1.596	92.593	"	2.151	414.71	"
2	160.265	"	1.558	415.77	"
2.093	186.775	"	0.730	410.16	"
2.256	268.920	"	0	397.58	"

Data are also given for 25°. Some uncertainty exists as to the terms in which the results are expressed. In some cases the column headings read "Gms. per liter of H_2O" and in others "Gms. per liter of solution." The saturation was effected by adding just the necessary amount of one constituent to cause the disappearance of the last particle of the other. The amounts so added were determined by weighing the flasks. At high concentrations of the two salts, the sudden increase in solubility appears to indicate a molecular combination.

SOLUBILITY OF BARIUM CARBONATE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AND OF SODIUM CHLORIDE.

(Cantoni and Goguelia, 1905.)

In KCl at B pt of Sol.		In NaCl at B pt. of Sol.		In 10% KCl Sol.		In 10% NaCl Sol.	
Gms KCl per 100 Gms Sol	Gms $BaCO_3$ per 1000 cc Sat Sol	Gms NaCl per 100 Gms Sol	Gms $BaCO_3$ per 1000 cc Sat Sol	t°.	Gms $BaCO_3$ per 1000 cc Sat Sol	t°.	Gms $BaCO_3$ per 1000 cc. Sat Sol
0.15	0.0847	0.15	0.0587	10	0.2175	10	0.1085
1.00	0.1781	1	0.0787	20	0.2408	20	0.1126
3	0.2667	3	0.1056	40	0.2972	40	0.1231
10	0.4274	10	0.1575	60	0.3491	40	0.1303
30	0.5550	30	0.2784	80	0.4049	40	0.1418

Barium carbonate boiled with aqueous NH_4Cl is slowly but completely decomposed. The time required varies inversely as the concentration of the NH_4Cl solution.

Data are also given for solubility in 10% aqueous KCl and NaCl at the boiling point, the time factor being varied from 1 to 198 hours.

Data for lowering of the melting point of $BaCO_3$ by Na_2CO_3 are given by Sackur (1911–12).

BARIUM CHLORATE $Ba(ClO_3)_2.H_2O$.

SOLUBILITY IN WATER.

(Carlson, 1910, Trautz and Anschutz, 1906.)

t°.	Sp. Gr. of Sat. Sol.	Gms $Ba(ClO_3)_2$ per 100 Gms Sat Sol		t°.	Sp. Gr. of Sat. Sol.	Gms $Ba(ClO_3)_2$ per 100 Gms Sat Sol	
0	1.195	20.3*	16.90†	40	1.355	35.8*	33.16†
10		24.3	21.23	60	1.433	42.6	40.05
20	1.274	28.2	25.26	80	1.508	48	45.90
25		30	27.53	100	1.580	53.1	51.2
30	...	32	29.13	105.6 b. pt.	1.600	54.6	52.62

* (C.) † (T and A.)

The determinations of Trautz and Anschutz appear to have been made with very great care. The original paper of Carlson was not available and it has been impossible to explain the discrepancy between the two sets of results.

BARIUM PerCHLORATE $Ba(ClO_4)_2.3H_2O$.

SOLUBILITY IN WATER.

(Carlson, 1910.)

t°.	Sp. Gr. Sat. Sol.	Gms $Ba(ClO_4)_2$ per 100 Gms Sat. Sol.	t°.	Sp. Gr. Sat. Sol.	Gms $Ba(ClO_4)_2$ per 100 Gms. Sat. Sol.
0	1.782	67.3	80	2.114	83.2
20	1.912	74.3	100	2.155	84.9
40	2.009	78.2	120	2.195	86.6
60	2.070	81	140	2.230	88.3

BARIUM CHLORIDE $BaCl_2.2H_2O$.

SOLUBILITY IN WATER.

(Mulder, Engel, 1888, Etard, 1894.)

t°.	Gms $BaCl_2$ per 100 Gms. Water	Gms $BaCl_2$ per 100 Gms. Solution	t°.	Gms $BaCl_2$ per 100 Gms. Water	Gms $BaCl_2$ per 100 Gms. Solution
0	31.6	24	60	46.4	31.3
10	33.3	25	70	49.4	33.1
20	35.7	26.3	80	52.4	34.4
25	37	27	100	58.8	37
30	38.2	27.7	130	59.5	37.3
40	40.7	28.9	160	63.6	38.9
50	43.6	30.4	215	75.9	43.1

Sp. Gr. of solution saturated at 0° = 1.25; at 20° = 1.27.

Solubility of Mixtures of Barium Chloride and Ammonium Chloride in Water.

At 30°. (Schreinemakers, 1908)

Gms. per 100 Gms. Sat. Sol. $BaCl_2$	Gms. per 100 Gms. Sat. Sol. NH_4Cl	Solid Phase
22.16	5.71	$BaCl_2.2H_2O$
18.36	10.06	"
15.42	13.84	"
10.89	20.01	"
8.33	24.69	"
7.97	25.92	$BaCl_2.2H_2O+NH_4Cl$
3.56	27.47	NH_4Cl

At Varying Temps. (Schreinemakers, 1910b)

t°	Gms. per 100 Gms. Sat. Sol. $BaCl_2$	Gms. per 100 Gms. Sat. Sol. NH_4Cl	Solid Phase
16.2	8.07	16.10	$BaCl_2.2H_2O+NH_4Cl$
0	8.22	19.26	"
30	8.19	24.89	"
40	8.40	26.93	"
50	8.55	29.53	"

Solubility of Barium Chloride in Aqueous Solutions of Barium Hydroxide and Vice Versa at 30°.

(Schreinemakers, 1909–1910, 1910b)

Gms. per 100 Gms. Sat. Sol. $BaCl_2$	Gms. per 100 Gms. Sat. Sol. BaO	Solid Phase
27.6	0	$BaCl_2.2H_2O$
27.42	1.78	"
27.36	1.77	" $+BaCl(OH).2H_2O$
24.98	2.33	$BaCl(OH).2H_2O$
21.40	3.27	"
19.18	4.67	"

Gms. per 100 Gms. Sat. Sol. $BaCl_2$	Gms. per 100 Gms. Sat. Sol. BaO	Solid Phase
18.67	4.61	$BaCl(OH).2H_2O+BaO.9H_2O$
18.04	4.62	$BaO.9H_2O$
17.08	4.60	"
12.81	4.58	"
10.77	4.45	"
0	4.99	"

Solubility of Mixtures of Barium Chloride and Barium Nitrate in Water.

At 30°. (Coppadoro, 1912, 1913)

Gms. per 100 Gms. Sat. Sol. $BaCl_2$	Gms. per 100 Gms. Sat. Sol. $Ba(NO_3)_2$	Solid Phase
6.06	9.55	$Ba(NO_3)_2$
13.75	8.20	"
16.14	7.92	"
22.70	7.94	"
26.11	7.88	$Ba(NO_3)_2+BaCl_2.2H_2O$
26.64	5.37	$BaCl_2.2H_2O$
26.91	4.13	"
27.38	1.58	"

At Varying Temps. (Etard, 1894)

t°	Gms. per 100 Gms. Sat. Sol. $BaCl_2$	Gms. per 100 Gms. Sat. Sol. $Ba(NO_3)_2$	Solid Phase
0	22.5	4.3	$BaCl_2.2H_2O+Ba(NO_3)_2$
20	24.5	6	"
40	26.5	7.5	"
60	28.5	9.5	"
100	31	14	"
140	32	20	"
180	33	26	"
210	32	32	"

Solubility of Barium Chloride in Aqueous Solutions of Copper Chloride at 30° and Vice Versa.

(Schreinemakers and de Baat, 1908–09)

Gms. per 100 Gms. Sat. Sol. $BaCl_2$	Gms. per 100 Gms. Sat. Sol. $CuCl_2$	Solid Phase
0	43.95	$CuCl_2.2H_2O$
1.25	42.45	"
3.08	42.07	" (unstable)
2.72	42.36	$CuCl_2.2H_2O+BaCl_2.2H_2O$
2.84	41.18	$BaCl_2.2H_2O$
3.98	37.42	"

Gms. per 100 Gms. Sat. Sol. $BaCl_2$	Gms. per 100 Gms. Sat. Sol. $CuCl_2$	Solid Phase
5.49	30.76	$BaCl_2.2H_2O$
10.13	21.76	"
17.08	11.49	"
22.78	5.13	"
27.6	0	"

Solubility data have been determined for the following systems:

$BaCl_2.2H_2O + CuCl_2.2H_2O + NH_4Cl + H_2O$ at 30°. (Schreinemakers, 1909)
" + " $+ KCl + H_2O$ at 40° and 60°. (" and de Baat, 1911)
" + " $+ NaCl + H_2O$ at 30°. (" and de Baat, 1908–09)
" $+ BaO + Na_2O + H_2O$ at 30°. (Schreinemakers, 1910b)
" $+ Ba(NO_3)_2 + NaNO_3 + NaCl + H_2O$ at 30°. (Coppadoro, 1913)
" $+ HCl + NaCl + H_2O$ at 30°. (Schreinemakers, 1909–10, 1910b)

Solubility of Barium Chloride in Aqueous Solutions of Hydrochloric Acid:

At 0°. (Engel, 1888.)

Sp. Gr. Sat. Sol.	Gms. per 100 Gms. Sat. Sol. HCl	Gms. per 100 Gms. Sat. Sol. $BaCl_2$
1.250	0	24.07
1.242	0.32	23.31
1.228	0.83	22.11
1.210	1.51	20.14
1.143	4.58	12.76
1.118	6.13	9.37
1.099	7.55	6.33
1.079	10.81	2.64
1.088	16.92	0.28

At 30°. (Masson, 1911, 1912-13, Schreinemakers, 1909-10.)

Sp. Gr. Sat. Sol.	Gms. per 100 Gms. Sat. Sol. HCl.	Gms. per 100 Gms. Sat. Sol. $BaCl_2$
1.3056	0	27.84
1.2651	1.36	24.02
1.2147	3.32	19.20
1.1789	5.01	15.2
1.1419	7.13	11.1
1.1068	10	5.8
1.0880	13.43	2.4
1.0895	16.92	0.38
1.1024	20.62	0
1.1609	32.18	0

The results of Schreinemakers show that at 37.34% HCl the barium chloride dihydrate is converted into monohydrate.

Less than 1 part of $BaCl_2$ is soluble in 20,000 parts of concentrated HCl and in 120,000 parts of conc. HCl containing $\frac{1}{6}$ volume of ether. (Mar, 1892.)

Solubility of Barium Chloride in Aqueous Solutions of Mercuric Chloride:

At 0°. (Schreinemakers, 1910.)

Gms. per 100 Gms. Sat. Sol. $HgCl_2$	Gms. per 100 Gms. Sat. Sol. $BaCl_2$	Solid Phase
0	23.70	$BaCl_2.2H_2O$
14.25	24	"
36.20	24.89	"
46.08	24.05	$BaCl_2.3HgCl_2.6H_2O + BaCl_2.2H_2O$
46.59	23.28	$BaCl_2.3HgCl_2.6H_2O$
47.78	21.05	"
48.46	20.67	" $+HgCl_2$
44.33	18.50	$HgCl_2$
29	11.59	"
16.36	6.11	"
3.95	0	"

At 30°. (Schreinemakers, 1910.)

Gms. per 100 Gms. Sat. Sol. $HgCl_2$	Gms. per 100 Gms. Sat. Sol. $BaCl_2$	Solid Phase
0	27.77	$BaCl_2.2H_2O$
2.90	27.56	"
12.98	26.99	"
34.57	26.69	"
40.50	25.22	"
55.22	23.17	" $+HgCl_2$
48.97	17.87	$HgCl_2$
41.30	14.26	"
27.62	8.41	"
14.19	2.65	"
7.67	0	"

Solubility of Mixtures of Barium Chloride and Mercuric Chloride in Water.

(Foote and Bristol — Am. Ch. J. **32**, 248, '04.)

t°.	Gms. per 100 Gms. Solution $BaCl_2$.	Gms. per 100 Gms. Solution $HgCl_2$.	Solid Phase.
10.4	23.58	50.54	$BaCl_2.2H_2O + HgCl_2$
10.4	23.44	50.74	Double Salt $BaCl_2.3HgCl_2.6H_2O$
10.4	22.58	51.23	"
10.4	22.48	51.41	"
10.4	22.10	51.66	Double Salt $BaCl_2.3HgCl_2.6H_2O$.
10.4	21.64	51.74	$BaCl_2.2H_2O + HgCl_2$.
25	23.02	54.83	"

Solubility of Mixtures of Barium Chloride and Sodium Chloride in Water:

At 30°. (Schreinemakers and de Baat, 1908-09.)

Gms. per 100 Gms. Sat. Sol. $BaCl_2$	Gms. per 100 Gms. Sat. Sol. NaCl	Solid Phase.
0	26.47	NaCl
2.28	25.28	"
3.80	23.77	" $+BaCl_2.2H_2O$
5.76	20.25	$BaCl_2.2H_2O$
8.19	17.89	"
12.25	13.39	$BaCl_2.2H_2O$
15.83	10.06	"
20.93	5.39	"
24.24	2.76	"
27.60	0	"

At Varying Temps. (Precht and Wittgen, 1881; Rudorff, 1885.)

t°.	Gms. per 100 Gms. Sat. Sol. $BaCl_2$	Gms. per 100 Gms. Sat. Sol. NaCl.
20	2.9	25
40	4.5	23
60	6.8	23.4
80	9.4	22.8
100	11.8	22.2

SOLUBILITY OF MIXTURES OF BARIUM CHLORIDE AND POTASSIUM CHLORIDE IN WATER (Foote, 1904.)

100 gms. saturated solution contain 13.83 gms. $BaCl_2$ + 18.97 gms. KCl at 25°.

Fusion-point curves (solubility, see footnote, p. 1) are given for the following mixtures:

$BaCl_2 + BaCO_3$	(Sackur, 1911–12.)
" $+ BaCrO_4$	"
" $+ BaO$	(Sackur, 1911–12, Arndt, 1907.)
" $+ BaSO_4$	(Sackur, 1911–12, Ruff and Plato, 1903.)
" $+ BaF_2$	(Botta, 1911, Ruff and Plato, 1903, Plato, 1907.)
" $+ BaI_2$	(Ruff and Plato, 1903.)
" $+ CdCl_2$	(Sandonini, 1911, 1914, Ruff and Plato, 1903.)
" $+ CaCl_2$	(Sandonini, 1911, 1914, Ruff and Plato, 1903, Schaefer, 1914.)
" $+ CuCl_2$	(Sandonini, 1914.)
" $+ PbCl_2$	(Sandonini, 1911, 1914, Ruff and Plato, 1903.)
" $+ LiCl$	(Sandonini, 1913, 1914.)
" $+ MgCl_2$	(Sandonini, 1912, 1914.)
" $+ MnCl_2$	(Sandonini, 1912, 1914, Ruff and Plato, 1903.)
" $+ KCl$	(Sandonini, 1911, Ruff and Plato, 1903, Vortisch, 1914.)
" $+ NaCl$	(Sackur, 1911–12, Ruff and Plato, 1903, Le Chatelier, 1894, Vortisch, 1914.)
" $+ NaCl + KCl$	(Vortisch, 1914(a), Gemsky.)
" $+ SrCl_2$	(Sandonini, 1911, 1914; Ruff and Plato, 1903, Vortisch, 1914.)
" $+ ZnCl_2$	(Sandonini, 1912 a, 1914.)
" $+ TlCl$	(Korreng, 1914.)

SOLUBILITY OF BARIUM CHLORIDE IN AQUEOUS ETHYL ALCOHOL SOLUTIONS.

At 15° (Schiff, 1861, Rohland, 1897.); At 30° and At 60° (Schreinemakers and Messink, 1910.)

At 15°: Wt % C_2H_5OH	At 15°: Gms $BaCl_2$ per 100 Gms Solvent	At 30°: Gms per 100 Gms Sat. Sol. C_2H_5OH	At 30°: $BaCl_2$	At 30°: Solid Phase	At 60°: Gms per 100 Gms Sat. Sol. C_2H_5OH	At 60°: $BaCl_2$	At 60°: Solid Phase
10	31.1	0	27.95	$BaCl_2.2H_2O$	0	31.57	$BaCl_2.2H_2O$
20	21.9	32.67	10.63	"	16.68	20.16	"
30	14.7	50.16	5.68	"	34.10	13.21	"
40	10.2	60.72	2.73	"	66.02	2.82	"
60	3.5	92.53	0.05	"	88.55	0.25	"
80	0.5	94.73	0.06	" $+ BaCl_2.H_2O$	90.25	0.09	" $+ BaCl_2.H_2O$
97	0.014	97.14		$BaCl_2.H_2O$	93.95		$BaCl_2.H_2O$
		98.17	0.08	" $+ BaCl_2$			
		99.41		$BaCl_2$			

100 gms. methyl alcohol dissolve 2.18 gms. $BaCl_2$ at 15.5° and 7.3 gms. $BaCl_2.2H_2O$ at 6°. (de Bruyn, 1892.)

100 gms. glycerol dissolve 9.73 gms. $BaCl_2$ at 15°–16°. (Ossendowski, 1907.)

100 cc. anhydrous hydrazine dissolve 31 gms. $BaCl_2$ at room temp. (Welsh and Broderson, 1915.)

100 gms. 95% formic acid dissolve 7.3 gms. $BaCl_2$ at 19°. (Aschan, 1913.)

One liter sat. sol. in nitrobenzene contains 0.167 gm. $BaCl_2$ at 20°, 0.33 gm. at 50° and 0.40 gm. at 100°. (Lloyd, 1918.)

Data for the system $BaCl_2$ + Triethylamine + H_2O are given by Timmermans (1907).

SOLUBILITY OF MIXTURES OF BARIUM CHLORIDE AND GLYCINE IN WATER AT 20°. (Pfeiffer and Modelski, 1912.)

Gms. per 100 cc. Sat. Sol. NH_2CH_2COOH	$BaCl_2$	Solid Phase
5.5	37	$BaCl_2.2H_2O + BaCl_2.2NH_2CH_2COOH.H_2O$
26	16	$NH_2CH_2COOH + BaCl_2.2NH_2CH_2COOH.H_2O$

BARIUM CHROMATE $BaCrO_4$.

SOLUBILITY OF BARIUM CHROMATE IN WATER.

One liter of sat. solution contains 0.002 gm. of the salt at 0°; 0.0028 gm. at 10°, 0.0037 gm. at 20° and 0.0046 gm. at 30°. (Kohlrausch, 1908)

Results higher than the above are given by Schweitzer, 1890, as follows: One liter of aqueous solution saturated at room temp. contains 0.01 gm. $BaCrO_4$; if ignited barium chromate is used, only 0.0062 gm. dissolves.

One liter sat. sol. contains 0.043 gm. of the salt at boiling point. (Mescherzski, 1882)

Fresenius (1890) gives the following: 1 liter of sat. sol. at room temp. contains 0.02 gm. of the salt, the solvent being 1.5% sol. of $CH_3CO_2NH_4$ and 0.022 gms. when the solvent is 0.5% sol. of NH_4NO_3.

One liter of 45% aq. ethyl alcohol solution dissolves 0.000022 gm. at room temp. (Guerini, 1912)

BARIUM CINNAMATES.

SOLUBILITY OF BARIUM CINNAMATES IN WATER, METHYL ALCOHOL AND ACETONE.

Compound	Formula.	t°.	Solvent	Gms. Anhydrous Salt per 100 Gms. Sat. Sol.	Authority.
Barium Cinnamate	$Ba(C_9H_7O_2)_2.2H_2O$	15	H_2O	0.726	(Tarugi and Checchi, 1901)
" "	"	100	"	2.27	" "
" Allocinnamate	$Ba(C_9H_7O_2)_2.H_2O$	19	CH_3OH	15.8	(Liebermann, 1903)
" "	"	12	"	15.4	(Michael and Garner, 1903)
" "	$Ba(C_9H_7O_2)_2.3H_2O$	20	"	2.56	(Michael, 1901)
" "	"	20	$(CH_3)_2CO$	0.80	"
" "	"	20	H_2O	6	"
" Hydrocinnamate	$Ba(C_9H_7O_2)_2.2H_2O$	27	"	2.9	"
" "	"	25	CH_3OH	0.1	"
" "	"	16	"	9.7	(Michael and Garner, 1903)
" Isocinnamate	"	20	"	70	(Michael, 1901)
" "	"	20	$(CH_3)_2CO$	20	"
" "	"	20	H_2O	17	"

BARIUM CITRATE $Ba_3(C_6H_5O_7)_2.7H_2O$.

SOLUBILITY IN WATER AND IN ALCOHOL.

100 grams water dissolve 0.0406 gram $Ba_3(C_6H_5O_7)_2.7H_2O$ at 18°, and 0.0572 gm. at 25°.

100 grams 95% alcohol dissolve 0.0044 gram $Ba_3(C_6H_5O_7)_2.7H_2O$ at 18°, and 0.0058 gm. at 25°.

(Partheil and Hubner — Archiv. Pharm. 241, 413, '03)

BARIUM CYANIDE $Ba(CN)_2$.

SOLUBILITY IN WATER AND IN ALCOHOL AT 14°.

(Joannis — Ann. chim. phys. [5] 26, 489, '82)

100 parts water dissolve 80 parts $Ba(CN)_2$.
100 parts 70% alcohol dissolve 18 parts $Ba(CN)_2$.

BARIUM FERROCYANIDE AND BARIUM POTASSIUM FERROCYANIDE.

(Wyrouboff — Ann. chim. phys. [4] 16, 292, '69)

100 parts water dissolve 0.1 part $Ba_2Fe(CN)_6.6H_2O$ at 15°, and 1.0 part at 75°.

100 parts water dissolve 0.33 part $BaK_2Fe(CN)_6.5H_2O$ at ord. temp.

BARIUM FLUORIDE BaF_2.

SOLUBILITY IN WATER.

(Kohlrausch, 1908)

One liter sat. sol. contains 1.586 gms. of the salt at 10°; 1.597 gms. at 15°; 1.607 gms. at 20°; 1.614 gms. at 25° and 1.620 gms. at 30°.

Freezing-point curves are given for mixtures of BaF_2+KF by Puschin and Baskow (1913), and for BaF_2+BaI_2 by Ruff and Plato (1903).

BARIUM FORMATE $Ba(HCOO)_2$.

SOLUBILITY IN WATER. (Stanley, 1904. See also Krasnicki, 1887.)

t°.	Gms $Ba(HCOO)_2$ per 100 Gms Sat. Sol.	t°.	Gms $Ba(HCOO)_2$ per 100 Gms Sat. Sol.
0	23.24	40	25
10	23.22	50	25.9
20	23.65	60	26.9
25	23.9	80	29.3
30	24.2	100	32.8

BARIUM HYDROXIDE $Ba(OH)_2.8H_2O$.

SOLUBILITY IN WATER. SOLID PHASE $Ba(OH)_2.8H_2O$.
(Rosenthal and Ruhlmann — Jahresber Chem 314, '70.)

t°.	Gms $Ba(OH)_2$ per 100 Gms Water	Gms $Ba(OH)_2$ per 100 Gms Solution.	t°.	Gms $Ba(OH)_2$ per 100 Gms Water	Gms $Ba(OH)_2$ per 100 Gms Solution
0	1.67	1.65	30	5.59	5.29
5	1.95	1.92	40	8.22	7.60
10	2.48	2.42	50	13.12	11.61
15	3.23	3.13	60	20.94	17.32
20	3.89	3.74	75	63.51	38.85
25	4.68	4.47	80	101.40	50.35

Data are given by Sill (1916), for the influence of pressures up to 490 kgs. per sq. cm on the solubility of $Ba(OH)_2.8H_2O$ in H_2O at 25°.

SOLUBILITY OF BARIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF BARIUM NITRATE AT 25° AND VICE VERSA. (Parsons and Carson, 1910.)

Sp. Gr. Sat. Sol.	Gms per 100 Gms H_2O: $Ba(OH)_2$	Gms per 100 Gms H_2O: $Ba(NO_3)_2$	Solid Phase	Sp. Gr. Sat. Sol.	Gms per 100 Gms H_2O: $Ba(OH)_2$	Gms per 100 Gms H_2O: $Ba(NO_3)_2$	Solid Phase
1.0512	4.29	0	$Ba(OH)_2.8H_2O$	1.1371	4.93	10.21	$Ba(OH)_2.8H_2O$
1.0651	4.35	1.88	"	1.1448	5.02	11.48	" $+Ba(NO_3)_2$
1.0790	4.48	3.47	"	1.1210	3.22	11.04	$Ba(NO_3)_2$
1.0975	4.40	5.66	"	1.1002	1.55	10.66	"
1.1220	4.72	7.55	"	1.0797	0	10.30	"

SOLUBILITY OF BARIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF ALKALI CHLORIDES AT 25°. (Herz, 1910.)

In Lithium Chloride. Gms per 100 cc Sat. Sol. LiCl	$Ba(OH)_2$	In Potassium Chloride. Gms per 100 cc Sat. Sol. KCl	$Ba(OH)_2$	In Rubidium Chloride. Gms per 100 cc Sat. Sol. RbCl	$Ba(OH)_2$	In Sodium Chloride. Gms per 100 cc Sat. Sol. NaCl	$Ba(OH)_2$
9.75	11.45	25.95	5.93	15.11	5.55	16.51	6.91
6.02	8.03	13.05	5.66	0	4.76	8.37	5.99
3.18	6.39	8.60	5.53	...	...	4.27	5.40
0	4.76	0	4.76	...	...	0	4.76

SOLUBILITY OF BARIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE AT 30°. (Schreinemakers, 1909-10.)

Gms per 100 Gms Sat. Sol. BaO	Na_2O	Solid Phase	Gms per 100 Gms Sat. Sol. BaO	Na_2O	Solid Phase.
4.99	0	$BaO.9H_2O$	1.84	26.14	$BaO.4H_2O$
1.29	4.78	"	1.75	27.72	"
0.89	6.43	"	1.58	28.43	"
0.57	9.63	"	1.34	29.24	" $+BaO.2H_2O$
0.53	11.62	"	0.82	32.12	$BaO.2H_2O$
0.47	17.87	"	0.59	34.72	"
1.06	23.28	"	0.57	41.09	" $+NaOH.H_2O$
1.87	24.63	$BaO.9H_2O+BaO.4H_2O$	0	+42	$NaOH.H_2O$

SOLUBILITY OF BARIUM HYDROXIDE IN AQUEOUS ACETONE AT 25°.
(Herz and Knoch — Z. anorg Chem. 41, 321, '04)

Sp Gr of Solutions	Vol % Acetone.	$Ba(OH)_2$ per 100 cc. Sat. Solution Millimols.	Grams.	Gms $Ba(OH)_2$ per 100 Gms Solution
1.0479	0	55.08	4.722	4.506
1.0168	10	31.84	2.730	2.686
0.9927	20	17.79	1.525	1.536
0.9763	30	9.10	0.779	0.798
0.9561	40	4.75	0.407	0.426
0.9398	50	1.54	0.132	0.141
0.9179	60	0.48	0.041	0.045
0.8956	70	0.08	0.007	0.018

Data for the systems $Ba(OH)_2$ + Phenol + H_2O at 25° and $Ba(OH)_2$ + Resorcinol + H_2O at 30° are given by van Meurs (1916).

BARIUM IODATE $Ba(IO_3)_2.H_2O$.

SOLUBILITY IN WATER.
(Trautz and Anschutz, 1906.)

t°.	Gms $Ba(IO_3)_2$ per 100 Gms Solution	t°.	Gms $Ba(IO_3)_2$ per 100 Gms Solution.	t°.	Gms $Ba(IO_3)_2$ per 100 Gms. Solution
−0.046	0.008	30	0.031	70	0.093
+10	0.014	40	0.041	80	0.115
20	0.022	50	0.056	90	0.141
25	0.028	60	0.07[illegible]	100	0.197

One liter sat. aqueous solution contains 0.3845 gm. $Ba(IO_3)_2$ at 25°.
(Harkins and Winninghoff, 1911)

At room temperature Hill and Zink (1909), found 0.284 gm. $Ba(IO_3)_2$ per liter sat. aqueous solution.

SOLUBILITY OF BARIUM IODATE IN AQUEOUS SALT SOLUTIONS AT 25°.
(Harkins and Winninghoff, 1911)

Added Salt	Mols Salt per Liter.	Gms $Ba(IO_3)_2$ per Liter	Added Salt	Mols Salt per Liter	Gms $Ba(IO_3)_2$ per Liter	Added Salt	Mols Salt per Liter	Gms $Ba(IO_3)_2$ per Liter
$Ba(NO_3)_2$	0.001	0.331	$Ba(NO_3)_2$	0.100	0.148	KNO_3	0.200	0.777
"	0.002	0.204	"	0.200	0.136	KIO_3	0.000106	0.368
"	0.005	0.237	KNO_3	0.00[illegible]	0.396	"	0.000530	0.303
"	0.020	0.164	"	0.010	0.445	"	0.001061	0.229
"	0.050	0.140	"	0.050	0.643			

100 cc. conc. ammonia (Sp. Gr 0.90) dissolve 0.0199 gm. $Ba(IO_3)_2$ at room temp (Hill and Zink, 1909)

100 cc. 95% ethyl alcohol dissolve 0.0011 gm. $Ba(IO_3)_2$ at room temp.
(Hill and Zink, 1909.)

BARIUM IODIDE BaI_2

SOLUBILITY IN WATER.
(Kremers — Pogg Ann 103, 66, 1858, Etard — Ann chim phys [7] 2, 544, '94)

t°	Gms BaI_2 per 100 Gms. Water	Solution	Solid Phase.	t°.	Gms BaI_2 per 100 Gms Water	Solution	Solid Phase.
−20	143.9	59.0	$BaI_2.6H_2O$	40	231.9	69.8	$BaI_2.2H_2O$
0	170.2	63.0	"	60	247.3	71.2	"
+10	185.7	65.0	"	80	261.0	72.3	"
20	203.1	67.0	"	100	271.7	73.1	"
25	212.5	68.0	"	120	281.7	73.8	"
30	219.6	68.7		160	294.8	74.6	"

Sp. Gr. of sat. solution at 19°.5 = 2.24.

100 gms. 95% HCOOH dissolve 75 gms. BaI_2 at 20.2°. (Aschan, 1913)

100 gms. 97% ethyl alcohol dissolve 1.07 gms. $BaI_2.2H_2O$ at 15°. (Rohland, 1897)

Data for the system BaI_2+BaO+H_2O at 25° are given by Milikau (1916).

BARIUM PerIODIDE BaI_4.

Data for the formation of barium periodide in aqueous solutions at 25° are given by Herz and Bulla (1911). (See reference calcium perbromide, p. 186.)

BARIUM IODOMERCURATE.

A saturated solution of BaI_2 and HgI_2 in water at 23.5° was found by Duboin (1906) to have the composition $BaI_2.1.33HgI_2.7.76H_2O$, $d = 2.76$.

BARIUM MALATE $BaC_4H_4O_5$.

SOLUBILITY IN WATER

(Cantoni and Basadonna — Bull soc chim [3] 35, 731, '06)

t°.	Gms $BaC_4H_4O_5$ per 100 cc Sol	t°.	Gms $BaC_4H_4O_5$ per 100 cc Sol	t°.	Gms $BaC_4H_4O_5$ per 100 cc Sol
20	0.883	35	0.895	60	1.011
25	0.901	40	0.896	70	1.041
30	0.903	50	0.942	80	1.044

SOLUBILITY IN WATER AND IN ALCOHOL.

(Partheil and Hubner — Archiv Pharm 241, 413, '03)

100 grams water dissolve 1.24 gms. $BaC_4H_4O_5$ at 18°, and 1.3631 gms. at 25°.

100 grams 95% alcohol dissolve 0.0038 gms. $BaC_4H_4O_5$ at 18°, and 0.0039 gm. at 25°.

BARIUM MALONATE $BaC_3H_2O_4.2H_2O$.

SOLUBILITY IN WATER.

(Miczynski — Monatsh Chem 7, 263, '86)

t°.	Gms $BaC_3H_2O_4$ per 100 Gms. Water	Gms $BaC_3H_2O_4$ per 100 Gms. Solution	t°.	Gms $BaC_3H_2O_4$ per 100 Gms. Water	Gms $BaC_3H_2O_4$ per 100 Gms. Solution
0	0.143	0.143	50	0.287	0.285
10	0.179	0.179	60	0.304	0.303
20	0.212	0.211	70	0.317	0.316
30	0.241	0.240	80	0.326	0.325
40	0.266	0.265			

Results slightly higher than the above, from 0°–50° are given by Cantoni and Diotalevi (1905).

BARIUM MOLYBDATE $BaMoO_4$

100 parts water dissolve 0.0058 part $BaMoO_4$ at 23°. (Smith and Bradbury, 1891)

BARIUM NITRATE $Ba(NO_3)_2$.

SOLUBILITY IN WATER

(Mulder, Gay Lussac, Etard — Ann chim phys [7] 2, 528, '94, Euler — Z physik Chem 49, 315, '04)

t°.	Gms $Ba(NO_3)_2$ per 100 Gms Water	Gms $Ba(NO_3)_2$ per 100 Gms Solution	t°.	Gms $Ba(NO_3)_2$ per 100 Gms Water	Gms $Ba(NO_3)_2$ per 100 Gms Solution
0	5.0	4.8	80	27.0	21.3
10	7.0	6.5	100	34.2	25.5
20	9.2	8.4	120	42.0	29.6
25	10.4	9.4	140	50.0	33.3
30	11.6	10.6	160	58.0	36.7
40	14.2	12.4	180	67.0	40.1
50	17.1	14.6	200	76.0	43.2
60	20.3	16.9	215	84.5	45.8

Results from 0°–35° differing from the above are given by Vogel (1903).

100 gms. sat. aqueous solution contains 4.74 gms. $Ba(NO_3)_2$ at 0°. (Coppadoro 1911.)

SOLUBILITY OF MIXTURES OF BARIUM NITRATE AND LEAD NITRATE IN WATER AT 25°. (Fock, 1897, Euler, 1904)

Sp. Gr. of Solution.	In Solution. Gms. per Liter $Ba(NO_3)_2$.	In Solution. Gms. per Liter $Pb(NO_3)_2$.	In Solution. Mg. Mols. per Liter. $Ba(NO_3)_2$.	In Solution. Mg. Mols. per Liter. $Pb(NO_3)_2$.	In Solution. Mol. % $Ba(NO_3)_2$.	In Solid Phase. Mol. % $Ba(NO_3)_2$
1.079	102.2	0	391.0	0	100	100
1.088	54.9	17.63	210.1	53.3	79.78	98.30
1.108	86.5	49.80	330.7	150.7	68.70	96.74
1.119	79.7	68.10	304.9	205.7	59.69	94.80
1.140	77.0	97.20	294.4	293.6	50.09	93.62
1.163	69.8	130.7	266.8	395.0	40.31	92.49
1.198	66.0	177.3	252.5	535.6	32.03	90.07
1.252	57.5	247.7	222.6	748.5	22.91	83.47
1.294	25.9	334.3	99.2	1010.3	8.11	75.44
1.376	28.8	429.7	110.3	1298.0	7.77	35.11
1.459	.	553.8	0.0	1673.0	0.0	0.0

Tables of results are also given for 15°, 30°, and 47°.

SOLUBILITY OF MIXTURES OF BARIUM NITRATE AND POTASSIUM NITRATE IN WATER.
(Findlay, Morgan and Morris, 1914, Foote, 1904.)

t°	Gms. per 100 Gms. Sat. Sol. $Ba(NO_3)_2$	Gms. per 100 Gms. Sat. Sol. KNO_3	Solid Phase	t°	Gms. per 100 Gms. Sat. Sol. $Ba(NO_3)_2$	Gms. per 100 Gms. Sat. Sol. KNO_3	Solid Phase.
9.1	6.25	0	*a*	25*	6.62	14.89	*a*+2*b*.*a*
9.1	4.20	8.15	*a*+2*b*.*a*	25	5.49	16.30	2*b*.*a*
9.1	1.98	12.02	2*b*.*a*	25	3.04	21.99	"
9.1	0.98	16.80	*b*+2*b*.*a*	25	2.04	27.76	*b*+2*b*.*a*
9.1	0	16.76	*b*	35	11.39	0	*a*
21.1	8.46	0	*a*	35	8.18	12.09	"
21.1	7.47	2.12	"	35	8.08	17.48	"
21.1	6.35	5.98	"	35	8.42	19.75	*a*+2*b*.*a*
21.1	6.06	8.47	"	35	5.85	24	2*b*.*a*
21.1	5.98	13.24	*a*+2*b*.*a*	35	5.02	26.05	"
21.1	3.35	18.24	2*b*.*a*	35	3.02	34.87	*b*+2*b*.*a*
21.1	2.30	21.47	"	35	1.77	34.98	*b*
21.1	1.76	24.86	*b*+2*b*.*a*	35	0	35.01	"
21.1	0	24.77	*b*				

* Results by Foote.

$a = Ba(NO_3)_2$, $2b.a = 2KNO_3.Ba(NO_3)_2$, $b = KNO_3$.

SOLUBILITY OF MIXTURES OF BARIUM NITRATE AND SODIUM NITRATE IN WATER.
(Coppadoro, at 0°, 1912, at 30°, 1913.)

Results at 0°.

Gms. per 100 Gms. Sat. Sol. $Ba(NO_3)_2$	Gms. per 100 Gms. Sat. Sol. $NaNO_3$	Solid Phase
4.33	0.41	$Ba(NO_3)_2$
3.34	1.68	"
2.50	3.54	"
1.60	8.02	"
1.56	12.71	"
1.53	20.24	"
1.56	27.74	"
1.55	30.81	"
1.49	35.83	"
1.55	40.85	98 % $Ba(NO_3)_2$ + 2 % $NaNO_3$
1.55	41.30	26 % " + 73.8 % "
1.54	42.06	2.6 % " + 97.4 % "
0.51	41.68	0 % " + 100 % "

Results at 30°.

Gms. per 100 Gms. Sat. Sol. $Ba(NO_3)_2$	Gms. per 100 Gms. Sat. Sol. $NaNO_3$	Solid Phase.
10.33	0	$Ba(NO_3)_2$
8.58	2.33	"
5.28	7.09	"
3.89	12.07	"
3.54	14.41	"
3.20	17.87	"
3.07	19.06	"
2.81	23.55	"
2.27	41.22	"
2.11	48.22	$Ba(NO_3)_2 + NaNO_3$
1	48.50	$NaNO_3$
0	49.16	"

SOLUBILITY OF BARIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 30°.
(Masson, 1911.)

Sp. Gr.	Gms per 100 cc Sat Sol HNO₃.	Gms per 100 cc Sat Sol $Ba(NO_3)_2$	Sp. Gr.	Gms per 100 cc Sat Sol HNO_3	Gms per 100 cc Sat Sol $Ba(NO_3)_2$
1.0891	0	54 31	1 0633	78 54	16 06
1.0811	8.303	30 50	1 0668	98 40	15 88
...	15.72	27 73	1 0783	125 9	14 90
1.0663	31 49	22.76	1 1050	188 6	14 11
1.0619	47.18	19 71	1.1341	251.6	13 75
1.0609	63	17 84	1 1645	315 7	13 52

Fusion-point curves (solubility, see footnote, p. 1) are given by Harkins and Clarke, 1915, for the following mixtures:

$Ba(NO_3)_2 + NaNO_3 + KNO_3$, $Ba(NO_3)_2 + NaNO_3$, $Ba(NO_3)_2 + KNO_3$,
$Ba(NO_3)_2 + LiNO_3$, $Ba(NO_3)_2 + LiNO_3 + KNO_3$.

SOLUBILITY OF BARIUM NITRATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°.
(D'Ans and Siegler, 1913.)

Gms C_2H_5OH per 100 Gms Solvent	Gms per 100 Gms Sat Sol C_2H_5OH	Gms per 100 Gms Sat Sol $Ba(NO_3)_2$	Gms C_2H_5OH per 100 Gms Solvent	Gms per 100 Gms Sat Sol C_2H_5OH	Gms per 100 Gms Sat Sol $Ba(NO_3)_2$
0	0	9 55	58	57	1 85
10 25	9 5	7 03	78 7	78 2	0 62
18 6	17 5	6 02	90 1	89 9	0 18
25 05	23 7	5 25	99 4	99 39	0 005
40 2	38 3	3 53			

Data are also given by Vogel (1903), but as the results are given in gms per 100 cc. and densities are omitted, no exact comparison can be made with the above.

SOLUBILITY OF BARIUM NITRATE IN AQUEOUS PHENOL SOLUTIONS AT 25°.
(Rothmund and Wilsmore — Z. physik Chem 40, 620, '02.)

G Mols per Liter C_6H_5OH	G Mols per Liter $Ba(NO_3)_2$	Gms per Liter C_6H_5OH	Gms per Liter $Ba(NO_3)_2$	G Mols per Liter C_6H_5OH	G Mols per Liter $Ba(NO_3)_2$	Gms per Liter C_6H_5OH	Gms per Liter $Ba(NO_3)_2$
0 000	0.3835	0 0	100 2	0 310	0 3492	29 12	91 31
0 045	0 3785	4 23	98 97	0 401	0 3400	37 73	88 90
0 082	0 3746	7 71	97 95	0 501	0 3299	47 11	86 26
0 146	0.3664	13 73	95 81	0 728 (sat.)	0 3098	68 45	81.00

Data for the above system are also given by Timmermans (1907).
100 gms hydroxylamine dissolve 11 4 gms $Ba(NO_3)_2$ at 17°-18°. (de Bruyn, 1892.)
100 cc anhydrous hydrazine dissolve 3 gms $Ba(NO_3)_2$ at room temp. (Welsh and Broderson, 1915.)
100 gms. methyl alcohol dissolve 0 5 gm $Ba(NO_3)_2$ at 25°. (D'Ans and Siegler 1913.)
100 gms. acetone dissolve 0 005 gm $Ba(NO_3)_2$ at 25°. " "

BARIUM NITRITE $Ba(NO_2)_2.H_2O$

SOLUBILITY IN WATER.
(Oswald, 1914; see also, Vogel, 1903.)

t°.	Gms $Ba(NO_2)_2$ per 100 Gms Sat. Sol.	Solid Phase	t°.	Gms $Ba(NO_2)_2$ per 100 Gms Sat. Sol.	Solid Phase
− 1.7	9 2	Ice	20	40 3	$Ba(NO_2)_2.H_2O$
− 3.2	19 5	"	43	50.3	"
− 5.8	33 1	"	61	58.6	"
− 6.5	34.5	" + $Ba(NO_2)_2.H_2O$	80	67.3	"
− 4.3	34 9	$Ba(NO_2)_2.H_2O$	92	71 7	"
+17	40*	"	110	82	"

* d of the sat solution = 1 4897

SOLUBILITY OF MIXTURES OF BARIUM NITRITE AND SILVER NITRITE IN WATER AT 13.5°. (Oswald, 1914.)

Gms per 100 Gms H_2O		Solid Phase
$Ba(NO_2)_2$	$AgNO_2$	
64	10.2	$AgNO_2+BaAg_2(NO_2)_4.H_2O$
75.6	9.5	$Ba(NO_2)_2+BaAg_2(NO_2)_4.H_2O$

SOLUBILITY OF BARIUM NITRITE IN AQUEOUS ALCOHOL SOLUTIONS AT 19.5°–20.5°. (Vogel, 1903.)

% alcohol in solvent:	10	20	30	40	50	60	70	80	90
Gms. $Ba(NO_2)_2.H_2O$ per 100 cc. sat. sol.	49.3	29.3	18.4	13.3	9.1	4.8	2.7	0.98	0

BARIUM OXALATE BaC_2O_4.

SOLUBILITY OF THE THREE HYDRATES IN WATER.
(Groschuff — Ber 34, 3318, '01.)

t°	$BaC_2O_4.3\frac{1}{2}H_2O$.		$BaC_2O_4.2H_2O$		$BaC_2O_4.\frac{1}{2}H_2O$	
	Gms BaC_2O_4 per 1000 g Sol	G M BaC_2O_4 per 100 Mol H_2O.	Gms BaC_2O_4 per 1000 g Sol	G M BaC_2O_4 per 100 G. M H_2O	Gms BaC_2O_4 per 1000 g Sol	G. M. BaC_2O_4 per 100 Mol. H_2O.
0	0.058	0.00046	0.053	0.00042	0.089	0.00070
9.5	0.082	0.00066		...	...	...
18	0.112	0.00090	0.080	0.00071	0.124	0.00099
30	0.170	0.00136	0.121	0.00097	0.140	0.00112
40	...	...	0.152	0.00122	0.151	0.00121
45	...	...	0.169	0.00135	...	...
50	...	...	...	...	0.164	0.00131
55	...	...	0.212	0.00170	...	...
60	...	...	...	...	0.175	0.00140
65	...	...	0.250	0.00200	...	...
73	...	...	0.285	0.00228	...	...
75	...	...	...	...	0.188	0.00151
90	...	...	...	...	0.200	0.00160
100	...	...	...	...	0.211	0.00169

The following additional data for the solubility of the above three hydrates in water are given by (Kohlrausch, 1908).

$BaC_2O_4.3\frac{1}{2}H_2O$		$BaC_2O_4.2H_2O$		$BaC_2O_4.\frac{1}{2}H_2O$	
t°	Gms per Liter	t°	Gms per Liter	t°	Gms per Liter
2.07	0.0553	3	0.0519	0.08	0.0499
4.2	0.059	5.47	0.0575	2.46	0.053
16.1	0.0962	11.28	0.0693	9.62	0.0619
17.8	0.1047	17.9	0.085	15.04	0.0699
		23.3	0.0987	17.54	0.0751
		28.4	0.1124	27.02	0.091
				33.73	0.1018

Cantoni and Diotalevi (1905) obtained higher results than either of the above.

SOLUBILITIES OF BARIUM OXALATE ($BaC_2O_4.\frac{1}{2}H_2O$) IN AQUEOUS ACETIC ACID AT 26°–27°. (Herz and Muhs, 1903.)

Normality of Acetic Acid.	G. Residue* per 50.05 cc. Sol	Gms per 100 cc Solution. CH₃COOH.	Gms per 100 cc Solution. Ba Oxalate.	Normality of Acetic Acid.	G Residue* per 50 cc. Sol.	Gms per 100 cc Solution CH₃COOH.	Gms per 100 cc Solution Ba Oxalate
0	0.0077	0.00	0.0154	3.85	0.0564	23.12	0.1127
0.565	0.0423	3.39	0.0845	5.79	0.0511	34.76	0.1021
1.425	0.0520	8.55	0.1039	17.30	0.0048	103.90	0.0096
2.85	0.0556	17.11	0.1111	...	...	...	...

* Dried at 70°.

BARIUM ACID OXALATE $BaC_2O_4.H_2C_2O_4.2H_2O$.

SOLUBILITY IN WATER.

(Groschuff.)

t°.	Gms per 100 Gms Solution.		Mols per 100 Mols H_2O		Mols $H_2C_2O_4$ per 1 Mol BaC_2O_4
	$H_2C_2O_4$.	BaC_2O_4	$H_2C_2O_4$	BaC_2O_4	
0	0.27	0.030	0.054	0.0024	22
18	0.66	0.070	0.130	0.0056	24
20.5	0.76	0.076	0.15	0.0061	25
38	1.61	0.16	0.33	0.013	25
41	1.82	0.18	0.37	0.015	25
53	2.92	0.31	0.60	0.026	24
60	3.60	0.40	0.75	0.033	22.5
80	6.21	0.81	1.34	0.070	19
90	7.96	1.11	1.75	0.098	18
99	10.50	1.55	2.39	0.141	17

BARIUM OXIDES.

Data for the lowering of the fusion points (solubility, see footnote, p. 1), of mixtures of BaO and B_2O_3 are given by Guertler (1904). Results for mixtures of BaO and $CaCl_2$ and for BaO and $SrCl_2$ are given by Sackur (1911-12).

BARIUM Glycerol **PHOSPHATES.**

SOLUBILITY IN WATER.

t°.	Compound	Formula	Gms Anhydrous Salt per 100 Gms Sat. Sol.	Authority
21	Barium Glycerolphosphate	$BaC_3H_7O_6P.H_2O$	4.5	(Rogier and Fiore, 1913.)
13	" α Glycerolphosphate	$BaC_3H_7O_6P$	1.4	(King and Pyman, 1914.)
12	" β "	$BaC_3H_7O_6P.\frac{1}{2}H_2O$	5.8	" "
21	" Glycerolphosphate	$BaC_3H_7O_6P.\frac{1}{2}H_2O$	8.4	(Langheld and Oppmann, 1912.)
22	" di Glycerolphosphate		3.76	" "

BARIUM PICRATE. Solubility in $H_2O + C_2H_5OH$ at 25°. (Fischer, 1914.)

BARIUM PROPIONATE $Ba(C_3H_5O_2)_2.H_2O$, also $6H_2O$.

SOLUBILITY IN WATER.

(Krasnicki — Monat h. Chem. 8, 597, '87.)

t°.	Gms $Ba(C_3H_5O_2)_2$ per 100 Gms Water	Gms $Ba(C_3H_5O_2)_2$ per 100 Gms Solution	t°.	Gms $Ba(C_3H_5O_2)_2$ per 100 Gms Water	Gms $Ba(C_3H_5O_2)_2$ per 100 Gms Solution
0	47.98	32.41	50	62.74	38.57
10	51.56	34.02	60	64.76	39.31
20	54.82	35.42	70	66.46	39.93
30	57.77	36.65	80	67.85	40.42
40	60.41	37.66	..	...	...

100 cc. 95% ethyl alcohol dissolve 0.1631 gm. barium propionate at room temp. (Crowell, 1918.)

BARIUM SALICYLATE $Ba(C_6H_4OHCOO)_2.H_2O$.

100 gms. sat. aqueous solution contain 28.65 gms. anhydrous salt at 15° and 54.08 gms. at 100°. (Tarugi and Checchi, 1901.)

BARIUM Dinitro**SALICYLATE.** Solubility in $H_2O + C_2H_5OH$ at 25°. (Fischer, 1914.)

BARIUM SILICATE $BaSiO_3$.

Fusion-point curves (solubility, see footnote, p. 1) for mixtures of:

$BaSiO_3 + CaSiO_3$ and $BaSiO_3 + MnSiO_3$ are given by (Lebedeu, 1911).
$BaSiO_3 + Li_2SiO_3$ and $BaSiO_3 + Na_2SiO_3$ are given by Wallace, 1909.
$BaSiO_3 + BaTiO_3$ are given by Smolensky (1911-12).

BARIUM STEARATE and Salts of Other Fatty Acids.

SOLUBILITY OF BARIUM STEARATE, PALMITATE, MYRISTATE AND LAURATE IN SEVERAL SOLVENTS. (Jacobson and Holmes, 1916.)

Solvent	t°.	Gms Each Salt (Determined Separately) per 100 Gms. Solvent. Ba Stearate	Ba Palmitate	Ba Myristate.	Ba Laurate.
Water	15.3	0.004	0.004	0.007	0.008
"	50	0.006	0.007	0.010	0.011
Abs. Ethyl Alcohol	16.5	0.006	0.009	0.009	0.010
" "	50	0.003	0.004	0.004	0.007
Methyl Alcohol	15	0.042	0.045	0.057	0.084
" "	50.5	0.077	0.088	0.108	0.163
Ether	25	0.001	0.001	0.003	0.007
Amyl Alcohol	25	0.007	0.008	0.009	0.009

BARIUM SUCCINATE AND BARIUM ISO SUCCINATE

$Ba.CH_2CH_2(COO)_2$. $Ba\ CH_3CH_2(COO)_2$.

SOLUBILITY OF EACH IN WATER.

(Miczynski — Monatsh Chem 7, 263, 1886.)

t°.	Gms Ba Succinate per 100 Gms Water	Solution.	Gms Ba Iso Succinate per 100 Gms Water	Solution
0	0.421	0.420	1.884	1.849
10	0.432	0.430	2.852	2.774
20	0.418	0.417	3.618	3.493
30	0.393	0.392	4.181	4.014
40	0.366	0.365	4.542	4.346
50	0.337	0.336	4.700	4.594
60	0.306	0.305	4.656	4.450
70	0.273	0.272	4.410	4.224
80	0.237	0.237	3.962	3.810

100 gms H_2O dissolve 0.396 gms. Ba Succinate at 18° and 0.410 gms at 25°.

100 gms 95% alcohol dissolve 0.0015 gms. Ba Succinate at 18° and 0.0016 gms. at 25°. (Partheil and Hubner — Archiv Pharm 241, 413, '03.)

Cantoni and Diotalevi (1905), and Tarugi and Checchi (1901), obtained data in close agreement with the above.

BARIUM SULFATE $BaSO_4$

SOLUBILITY IN WATER. (Kohlrausch, 1908.)

One liter of sat. solution contains 0.00115 gm. $BaSO_4$ at 0°, 0.0020 gm. at 10°; 0.0024 gm at 20° and 0.00285 gm at 30°.

Melcher (1910) obtained results a little lower than the above. His data for higher temperatures are 0.00336 gm. at 50° and 0.0039 gm at 100°.

Kohlrausch obtained the following results for the solubility of heavy spar ($BaSO_4$); 0.0019 gm. at 0°, 0.0023 gm. at 10°; 0.0027 gm. at 20°; 0.00315 gm at 30° and 0.0033 gm at 33.5°.

100 gms sat. solution of $BaSO_4$ in 21.37% aqueous ammonium acetate solution contain 0.016 gm. at 25°. (Marden, 1916.)

SOLUBILITY OF BARIUM SULFATE IN AQUEOUS SOLUTIONS OF IRON, ALUMINIUM AND MAGNESIUM CHLORIDES AT 20°-25°. (Fraps, 1901.)

Gms Chloride per Liter.	Milligrams $BaSO_4$ per Liter in Aq $FeCl_3$	Aq $AlCl_3$	Aq $MgCl_2$	Gms Chloride per Liter.	Mgs $BaSO_4$ per Liter in Aq $FeCl_3$.	Aq $AlCl_3$	Aq $MgCl_2$
1	58	33	30	25	150	116	50
2½	72	43	30	50	160	170	50
5	115	60	33	100	170	175	50
10	123	94	33	...	...	...	..

SOLUBILITY OF BARIUM SULFATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC AND OF NITRIC ACIDS.

(Banthisch, 1884.)

In Hydrochloric Acid				In Nitric Acid			
cc containing 1 Mg Equiv. of HCl.	Mgs. $BaSO_4$ per 1 Mg Equiv. of HCl.	Gms per 100 cc Solution: HCl.	Gms per 100 cc Solution: $BaSO_4$	cc containing 1 Mg Equiv. of HNO_3.	Mgs $BaSO_4$ per 1 Mg Equiv. of HNO_3.	Gms per 100 cc Solution: HNO_3	Gms per 100 cc Solution: $BaSO_4$
2	0.133	1.82	0.0067	2	0.140	3.15	0.0070
1	0.089	3.65	0.0089	1	0.107	6.31	0.0107
0.5	0.056	7.29	0.0101	0.5	0.085	12.61	0.0170
0.2	0.017	18.23	0.0086	0.2	0.048	31.52	0.0241

100 cc. HBr dissolve 0.04 gm $BaSO_4$; 100 cc. HI dissolve 0.0016 gm. $BaSO_4$ at the boiling point. (Haslam, 1886.)

SOLUBILITY OF BARIUM SULFATE IN CONCENTRATED AQUEOUS SOLUTIONS OF SULFURIC ACID AT 20°.

(Von Weimarn, 1911.)

Gms H_2SO_4 per 100 Gms Solvent.	Gms $BaSO_4$ per 100 cc Sat Sol	Gms H_2SO_4 per 100 Gms Solvent.	Gms $BaSO_4$ per 100 cc Sat Sol
73.83	0.0030	85.78	0.3215
78.04	0.0135	88.08	1.2300
80.54	0.0285	93	*
83.10	0.0800	96.17	4.9665
84.15	†	96.46	18.6000

* Solid Phase = $BaSO_4(H_2SO_4)_2H_2O$ + $BaSO_4.H_2SO_4$ † Solid Phase = $BaSO_4$ + $BaSO_4.H_2SO_4.H_2O$

Data for the above system are also given by Volkhouski (1910).

100 cc sat solution of $BaSO_4$ in abs H_2SO_4 contain 28.51 gms $BaSO_4$, solid phase = $BaSO_4.3oH_2SO_4$. (Bergius, 1910.)

100 cc of sat. solution of $BaSO_4$ in 95% formic acid contain 0.01 gm $BaSO_4$ at 18.5°. (Aschan, 1913.)

Fusion-point curves (solubility, see footnote, p. 1) are given the following mixtures of barium sulfate and other salts:

$BaSO_4$ + NaCl	(Sackur, 1911-12.)
" + KCl	"
" + $CaCl_2$	"
" + K_2SO_4	(Grahmann, 1913; Calcagni, 1912.)
" + Li_2SO_4	(Calcagni and Marotta, 1912.)
" + Na_2SO_4	(Calcagni, 1912.)

BARIUM Amyl SULFATE $Ba(C_5H_{11}SO_4)_2.2H_2O$

SOLUBILITY OF MIXED CRYSTALS OF THE ACTIVE AND INACTIVE SALT IN WATER AT 20.5°.

(Marckwald, 1904.)

Gms Salt per 100 Gms H_2O	Per cent Active Salt in Dissolved Salt	Gms Salt per 100 Gms H_2O	Per cent Active Salt in Dissolved Salt
28.2	100	18.3	49.6
26.3	91.6	16.6	36.3
24.8	84.5	15	25.8
21.7	71.2	13.6	10.6
19.5	59.5	12.8	0

Mixed crystals of the active and inactive barium amyl sulfate were dissolved in water by warming, then cooled to the beginning of crystallization and shaken two hours at 20.5°. The percentage of the active salt was determined by the polariscope. Its specific rotation was $[\alpha]_D = +2.52°$.

BARIUM Isoamyl **SULFATE** $Ba(C_5H_{11}SO_4)_2.2H_2O$.

100 gms. H_2O dissolve 9.71 gms. of the anhydrous salt at 10°, 11.85 gms. at 19.3° and 12.15 gms. at 20.5°. (Marckwald, 1902)

BARIUM Per**SULFATE** $BaS_2O_8.4H_2O$.

100 parts water dissolve 39.1 parts BaS_2O_8 or 52.2 parts $BaS_2O_8.4H_2O$ at 0°.

(Marshall — J Ch Soc. 59, 771, '91.)

BARIUM SULFITE $BaSO_3$.

SOLUBILITY IN WATER AND IN AQUEOUS SUGAR SOLUTIONS.

(Rogowicz — Z. Ver Zuckerind 938, 1905)

Conc of Sugar Sol.	Gm $BaSO_4$ per 100 cc Sol. at 20°.	at 80°.	Conc of Sugar Sol	Gm $BaSO_4$ per 100 cc. Sol. at 20°	at 80°.
0° Bx	0 0197	0.00177	40° Bx	0 0048	0 00158
10° "	0 0104	0 00335	50° "	0 0030	0 00149
20° "	0 0097	0 00289	60° " (sat.)	0 0022	0 00112
30° "	0 0078	0 00223	...	..	...

BARIUM SULFONATES.

SOLUBILITY OF SEVERAL BARIUM SULFONATES IN WATER.

Salt	Formula	t°	Gms Anhydrous Salt per 100 Gms. H_2O.	Authority.
Barium:				
3.4 Diiodobenzene Sulfonate	$C_{12}H_6O_6I_4S_2Ba\ H_2O$	21 5	0 27	(Boyle, 1909)
2 5 " "	$C_{12}H_6O_6I_4S_2Ba\ 1\frac{1}{2}H_2O$	20	0 522	"
2 Phenanthrene Sulfonate	$(C_{14}H_9SO_3)_2Ba\ \frac{1}{2}H_2O$	20	0 016	(Sandquist, 1912)
3 " "	$(C_{14}H_9SO_3)_2Ba\ 3H_2O$	20	0 03	"
10 " "	$(C_{14}H_9SO_3)_2Ba\ 3H_2O$	20	0 13	"
Bromobenzene Sulfonate	$(C_6H_4BrSO_3)_2Ba$	17 5	3 31	(Meyer, 1875.)

BARIUM TARTRATE $Ba(C_2H_2O_3)_2$

SOLUBILITY IN WATER.

(Cantoni and Zachoder — Bull. soc chim [3] 33, 751, '05, see also Partheil and Hubner)

t°.	Gms $Ba(C_2H_2O_3)_2$ per 100 cc. Solution	t°.	Gms $Ba(C_2H_2O_3)_2$ per 100 cc Solution	t°.	Gms $Ba(C_2H_2O_3)_2$ per 100 cc Solution
0	0 0205	30	0 0315	70	0 0480
10	0 0242	40	0.0352	80	0 0527
20	0 0279	50	0 0389	85	0 0541
25	0 0297	60	0 0440	..	...

SOLUBILITY OF BARIUM TARTRATE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE, SODIUM CHLORIDE AND AMMONIUM CHLORIDE.

(Cantoni and Jolkowski, 1907)

At Different Temperatures. Varying Concentrations at 16°.

t°.	Gms $Ba(C_2H_2O_3)_2$ per 100 cc Sat Sol in 7% KCl.	7% NaCl	7% NH_4Cl	Gms Chloride per 100 Gms Solvent.	Gms $Ba(C_2H_2O_3)_2$ per 100 cc Sat Sol in KCl.	NaCl	NH_4Cl
16	0.0823	0 0887	0.1050	0.5	0 0398	0.0410	0.0441
30	0.1017	0 1151	0.1370	1	0.0466	0.0514	0.0589
55	0.1230	0 1348	0 1590	3	0.0723	0 0826	0 0892
70	0.1500	0.1781	0.2030	10	0.1199	0.1260.	0.1342
85	0.1828	0.2168	0.2360	15	0 1435	0.1440	0.1585
				20	0.1466	0.1573	0.1663

(See Note p 222)

SOLUBILITY OF BARIUM TARTRATE IN AQUEOUS ACETIC ACID SOLUTIONS AT 26°-27°.

(Herz and Muhs, 1903.)

Normality of Acetic Acid	Gms residue* per 50 cc. Sol	Gms per 100 cc Solution CH$_3$COOH	Gms per 100 cc Solution Ba tartrate	Normality of Acetic Acid	Gms residue* per 50 cc Sol	Gms per 100 cc Solution CH$_3$COOH	Gms per 100 cc Solution Ba tartrate
0	0.0328	0	0.0655	3.77	0.1866	22.02	0.3728
0.565	0.1151	3.39	0.2300	5.65	0.1865	33.90	0.3726
1.425	0.1559	8.55	0.3115	16.85	0.0218	101.10	0.0436
2.85	0.1739	17.11	0.3475				

* Dried at [illegible]

100 grams 95% alcohol dissolve 0.032 gm. Ba tartrate at 18° and 0.0356 gm at 25°. (Partheil and Hübner.)

BARIUM β TRUXILATE. $BaC_{18}H_{14}O_4 \cdot 2H_2O$

100 cc. sat. solution in water contain 0.028 gm. of the salt at 26°. (de Jong, [illegible])

BEHENIC ACID $C_{21}H_{43}COOH$

Freezing-point data (solubility, see footnote, p. 1) are given for the following mixtures of behenic acid and other compounds.

Behenic Acid + Erucic Acid (Mascarelli and Sanna, 1915.)
" + Isoerucic Acid
" + Brassidinic Acid "
" + Isobehenic Acid (Meyer, Brod and Soyka, 1913.)
" Methylester + Isobehenic Acid Methyl Ester " " "

BENZALANILINE $C_6H_5CH:NC_6H_5$

Solubility data determined by the freezing point method are given by Pascal and Normand (1913), for mixtures of benzalaniline and each of the following compounds: Azobenzene, benzylaniline, dibenzyl, hydrazobenzene, stilbene and tolane.

BENZALAZINE $C_6H_5CH:N \cdot N:CHC_6H_5$

Solubility data determined by the freezing-point method are given by Pascal (1914), for mixtures of benzalazine and each of the following compounds: Diphenylhydrazine, diphenyldiacetylene, naphthalene, furfuralazine, diphenylbutadiene and cinnamylidene. Data are also given for mixtures of thiophenylalazine and cinnamylidene.

BENZALDEHYDE C_6H_5CHO

100 gms. H_2O dissolve 0.3 gm. C_6H_5CHO at room temp. (Flückiger, [illegible], U. S. P.)

Freezing-point data for mixtures of C_6H_5CHO and HNO_3 are given by Zukow and Kasatkin (1909).

Para Hydroxy**BENZALDEHYDE** $p\,C_6H_4OH \cdot CHO$

Freezing-point data are given for mixtures of p hydroxybenzaldehyde + dimethylaniline and p hydroxybenzaldehyde + phenol. (Schmidlin and Lang, [illegible])

Ortho Nitro**BENZALDEHYDE** $o\,C_6H_4NO_2 \cdot CHO$

SOLUBILITY IN WATER AND IN AQUEOUS SOLUTIONS AT 25°.

(Goldschmidt and Sunde, 1906.)

Solvent	Gms $C_6H_4NO_2$ CHO per 100 cc Sat. Sol.	Solvent	Gms $C_6H_4NO_2$ CHO per 100 cc Sat. Sol.	Solvent	Gms $C_6H_4NO_2$ CHO per 100 cc Sat. Sol.
H_2O	0.2310	1 n NaCl	0.1899	1 n KNO_3	0.3199
0.5 n HCl	0.2391	2 n "	0.1390	2 n "	0.3419
1 n "	0.2466	0.5 n HNO_3	0.3207	0.5 n $NaNO_3$	0.3013
2 n "	0.2658	1 n "	0.3758	1 n "	0.3132
1 n KCl	0.2046	0.5 n KNO_3	0.3123	2 n "	0.3201
2 n "	0.1912				

Meta Nitro**BENZALDEHYDE** *m* $C_6H_4NO_2.CHO$.

100 cc. H_2O dissolve 0.1625 gm. *m* $C_6H_4NO_2.CHO$ at 25° (Goldschmidt and Sunde, 1906.)
" 1 *n* HCl " 0.1813 " " " " "
" 1 *n* KCl " 0.1542 " " " " "
" 2 *n* KCl " 0.1417 " " " " "

Para Nitro**BENZALDEHYDE** *p* $C_6H_4NO_2.CHO$.

Data for the system *p* nitrobenzaldehyde + nitrobenzene + hexane are given by Timmermans (1907).

Solubility data determined by the freezing-point method are given for:

p Nitrobenzaldehyde + Sulfuric Acid (Kendall, 1914)
m " + Benzene (Schmidlin and Lang, 1912.)
m " + Phenol " "

BENZALDOXIME $C_6H_5CH \cdot NOH$.

Solubility data determined by the freezing-point method are given for mixtures of:

α Benzaldoxime + β Benzaldoxime (Cameron, 1898)
α Nitrobenzaldoxime + β Nitrobenzaldoxime. (Beck, 1904)

BENZAMIDE $C_6H_5CONH_2$.

SOLUBILITY IN ETHYL ALCOHOL.

(Speyers — Am. J. Sci [4] 14, 295, '02)

t°.	Sp Gr of Solutions	G M $C_6H_5CONH_2$ per 100 G M. C_2H_5OH.	Gms $C_6H_5CONH_2$ per 100 Gms C_2H_5OH.	t°.	Sp Gr of Solutions	G M $C_6H_5CONH_2$ per 100 G M C_2H_5OH	Gms. $C_6H_5CONH_2$ per 100 Gms. C_2H_5OH
0	0 833	3 1	8 15	40	0 848	11.0	28 92
10	0 832	4 2	11 04	50	0 862	14 2	37 34
20	0 833	5 9	15 52	60	0 881	17 2	45 22
25	0 835	6 8	17 87	70	0 913	20.4	53.63
30	0 838	8 2	21 56	..	...	...	...

SOLUBILITY OF BENZAMIDE IN MIXTURES OF ALCOHOL AND WATER AT 25°.

(Holleman and Antusch — Rec trav chim 13, 294, '94)

Vol % Alcohol.	Gms $C_6H_5CONH_2$ per 100 Gms Solvent	Sp Gr of Solutions	Vol % Alcohol	Gms $C_6H_5CONH_2$ per 100 Gms. Solvent	Sp Gr of Solutions.
100	17 03	0 830	70	23 87	0 925
95	21 12	0 856	60	18 98	0 939
90	24 50	0 878	50	13 74	0 949
85	26 15	0 895	40	8.62	0 958
83	26.63	0 900	31	5.33	0.967
80	26 43	0 907	15	2.28	0 982
75	25 41	0 917	0	1 35	0.999

See remarks under α Acetnaphthalide, p. 13.

100 gms. pyridine dissolve 31.23 gms. benzamide at 20°-25°. (Dehn, 1917.)
100 gms. aq. 50% pyridine dissolve 39 15 gms benzamide at 20°-25°. "

The coefficient of distribution of benzamide between oil and water is 0.66 at 3° and 0.43 at 36°. (Meyer, 1900, 1909)

BENZANILIDE.

Solubilities determined by the freezing-point method are given by Vanstone (1913) for mixtures of benzanilide and each of the following compounds: benzil, benzylideneaniline, and benzoin.

Results for mixtures of *o* chlorobenzanilide and *p* chlorobenzanilide are given by King and Orton (1911).

BENZENE C_6H_6.

SOLUBILITY IN WATER AT 22°.

(Herz — Ber. 31, 2671, '98.)

100 cc. water dissolve 0.082 cc. C_6H_6, Vol. of Sol. = 100.082, Sp. Gr. = 0.9979.
100 cc. C_6H_6 dissolve 0.211 cc. H_2O, Vol. of sol. = 100.135, Sp. Gr. = 0.8768.

SOLUBILITY OF WATER IN BENZENE.

(Groschuff, 1911.)

t°.	Gm. H_2O per 100 Gms. Sat. Sol.	t°.	Gms. H_2O per 100 Gms. Sat. Sol.
3	0.030	55	0.184
23	0.061	66	0.255
40	0.114	77	0.337

BENZENE, AQ. ALCOHOL MIXTURES; BENZENE, AQ. ACETONE MIXTURES AT 20°.

H_2O added to mixtures of known amounts of the other two and appearance of clouding noted.

(Bancroft — Phys. Rev. 3, 31, 1895-96.)

C_6H_6, C_2H_5OH and H_2O Per 5 cc. C_2H_5OH		C_6H_6, CH_3OH and H_2O Per 5 cc. CH_3OH		C_6H_6, $(CH_3)_2CO$ and H_2O Per 5 cc. $(CH_3)_2CO$	
cc. H_2O.	cc. C_6H_6	cc. H_2O	cc. C_6H_6	cc. H_2O	cc. C_6H_6
20	0.03	5.0	0.15	8.0	0.10
8	0.13	3.0	0.215	3.0	0.395
4	0.39	2.0	0.59	2.0	0.69
2	1.17	1.4	1.0	1.3	1.0
1.5	1.87	1.0	1.9	0.51	2.0
1.0	3.57	0.8	3.0	0.295	3.0
0.605	8.0	0.69	4.0	0.2	4.0
0.34	20.0	0.49	8.0	0.15	5.0

C_2H_5OH added to mixtures of known amounts of C_6H_6 and H_2O until the solutions became homogeneous at 20°. (Lincoln, 1900.)

Per 5 cc. C_6H_6		Per 5 cc. C_6H_6		Per 5 cc. C_6H_6	
cc. H_2O	cc. C_2H_5OH	cc. H_2O	cc. C_2H_5OH	cc. H_2O	cc. C_2H_5OH
1	4.6	20	31.6	50	58
5	12.8	30	41.4	60	65.6
10	19.8	40	39.5	70	73.1

Lincoln also gives results at 10°. Data of a similar character for mixtures of benzene, ethyl alcohol and water at 20, 25 and 35° are given by Taylor (1897).

For results at 15°, see page 287.

Data for mixtures of benzene, ethyl alcohol and glycerol and for mixtures of benzene, ethyl alcohol and lactic acid are given by Rozsa (1911).

MUTUAL SOLUBILITY OF BENZENE AND CARBON TETRACHLORIDE.

(Determined by the synthetic method.)

(Baud, 1913.)

t°.	Gms. C_6H_6 per 100 Gms. Mixture.	t°.	Gms. C_6H_6 per 100 Gms. Mixture.	t°.	Gms. C_6H_6 per 100 Gms. Mixture.
−24.2	0	−40	19.3	−20	48
−30	2.8	−34	24.2	−10	64.1
−40	8.5	−35 tr. pt.	31	0	85.3
−46.3 Eutec.	12.9	−30	36	+5.5	100

MUTUAL SOLUBILITY OF BENZENE AND CHLOROFORM. FREEZING-POINT METHOD. (Wroczynski and Guye, 1910.)

t°.	Gms C_6H_6 per 100 Gms Solution	Solid Phase.	t°.	Gms C_6H_6 per 100 Gms Solution	Solid Phase.	t°.	Gms C_6H_6 per 100 Gms Solution	Solid Phase.
−63.5	0	$CHCl_3$	−60	26.8	C_6H_6	−20	58.3	C_6H_6
−70	11.8	"	−50	32	"	−10	70.8	"
−75	14.7	"	−40	39	"	0	88	"
−81.7	18.4	$CHCl_3+C_6H_6$	−30	47.8	"	5	100	"
−70	22.6	C_6H_6						

The eutectic point was found by extending the curves to their intersection. The temperature of the eutectic could not be reached by use of liquid CO_2.

MUTUAL SOLUBILITY OF BENZENE AND FORMIC ACID. SYNTHETIC METHOD. (Ennis, 1914.)

t° of Miscibility	Gms HCOOH per 100 Gms Sol.	t° of Miscibility	Gms HCOOH per 100 Gms Sol.	t° of Miscibility	Gms HCOOH per 100 Gms Sol.
21	9.2	70	31.5	60	74
30	10.3	72	35	40	82
40	12.2	73.2	43–51	20	87
50	16.5	72	60	5	89.6
60	22	70	65		

SOLUBILITY OF BENZENE IN AQUEOUS SOLUTIONS OF FORMIC ACID. SYNTHETIC METHOD. (Ennis, 1914.)

In 95 Wt. % HCOOH.		In 85 Wt. % HCOOH.		In 75 Wt. % HCOOH.		In 60 Wt. % HCOOH.	
t° of Miscibility.	Gms C_6H_6 per 100 Gms Sol.	t° of Miscibility.	Gms C_6H_6 per 100 Gms Sol.	t° of Miscibility.	Gms C_6H_6 per 100 Gms Sol.	t° of Miscibility.	Gms C_6H_6 per 100 Gms Sol.
57.5	96.3	71	97.5	122	12	105	6
77	94.4	87	96.6	97.5	8.5	82	3.8
95	89.8	101	96	74	6	76	3
112	85.2	100.5	14.3				
94.5	24.7	81	10				
80.5	20	46	7				
51	12.5						

MUTUAL SOLUBILITY OF BENZENE AND ETHYL ALCOHOL. FREEZING-POINT METHOD. (Viala, 1914, see also Rozsa, 1911 and Pickering, 1893.)

t°.	Gms C_6H_6 per 100 Gms Sol.	t°.	Gms C_6H_6 per 100 Gms Sol.	t°.	Gms C_6H_6 per 100 Gms Sol.
−113.9	0	−60	19.3	−10	57.6
−100	8	−50	24.1	0	85
−90	10	−40	29.8	1	93
−80	12	−30	37	5.5	100
−70	15	−20	45.7		

MUTUAL SOLUBILITY OF BENZENE AND β NAPHTHALENE PICRATE, $C_6H_2(NO_2)_3OH.C_{10}H_7OH$. (Kuriloff, 1897.)

Synthetic method used — see Note, p. 16

t°.	Gms Picrate.	Gms Benzene.	a	t°.	Gms Picrate.	Gms Benzene.	a
157	100	...	100.0	111.6	1.173	1.037	19.2
148.4	2.128	0.115	79.3	102.0	1.087	1.780	11.2
137.4	1.274	0.170	61.1	29.5	0.390	8.430	0.95
134.2	1.384	0.297	49.3	4.6	1.329	21.80	0.48
126.8	1.019	0.343	38.3	5.02	...	100.0	...

a = Mols. β Naphthalene Picrate per 100 Mols. of β Napthalene Picrate plus Benzene.

Determinations for a large number of isothermes are also given.

THE SYSTEM BENZENE, PHENOL AND WATER AT 25°.

(Horiba, 1914.)

In the case of phenol, the bromine method was used for its determination. In the case of the other two compounds, the amounts required to produce constant turbidity were measured directly from burettes.

Solubility of Benzene in Aqueous Solutions Containing Phenol and Vice Versa.

d_{25}^{25}	Gms. per 100 Gms. $C_6H_5OH+C_6H_6+H_2O$: C_6H_5OH	C_6H_6	Saturating Phase
1.0002	0	0.198	C_6H_6
1.0008	1.059	0.204	"
1.0021	2.602	0.205	"
1.00305	3.526	0.199	"
...	5.65	0.17	$C_6H_6+C_6H_5OH$
...	5.953	0.132	C_6H_5OH
1.0059	6.516	0.075	"
1.0069	7.683	0.025	"
1.0073	8.195	0	"

Solubility of Phenol in Benzene Solutions Containing Water and Vice Versa.

d_{25}^{25}	Gms. per 100 Gms. $C_6H_5OH+C_6H_6+H_2O$: C_6H_5OH	C_6H_6	Saturating Phase
...	29.29	0	C_6H_5OH
...	71.63	1.62	"
...	74.5	3	$C_6H_5OH+C_6H_6$
1.0256	69.18	16.33	C_6H_6
0.9891	55.80	36.13	"
0.9629	44.39	50.56	"
0.9142	21.15	77.22	"
0.8818	4.78	94.98	"
0.8764	0	99.95	"

Data are also given for the solubility of phenol as solid phase, in C_6H_6 and in water and in their mixtures. A complete table for the conjugate points, showing the distribution of phenol between the aqueous and the benzene layers, is given. The results agree with those of Rothmund and Wilsmore. See page 482.

RECIPROCAL SOLUBILITY, DETERMINED BY FREEZING-POINT METHOD, OF MIXTURES OF

Benzene and Phenol.

(Hatcher and Skirrow, 1917.)

t° of Melting.	Gms. C_6H_6 per 100 Gms. Mixture.	Solid Phase.
39.4	0	C_6H_5OH
30	11.8	"
20	25	"
10	38.2	"
0	51.5	"
−5.4 Eutec.	58.4	" $+C_6H_6$
−2.5	67.5	C_6H_6
0	78.3	"
+2.5	89	"
5.1	100	"

Benzene and Pyridine.

(Hatcher and Skirrow, 1917.)

t° of Melting.	Gms. C_6H_6 per 100 Gms. Mixture.	Solid Phase.
−39.4	0	C_5H_5N
−45	10	"
−50	17	"
−55	23.3	"
−58 Eutec.	26	" $+C_6H_6$
−50	31	C_6H_6
−40	37.7	"
−30	46	"
−20	57	"
−10	71.5	"
0	90.5	"

Additional data on the system Benzene + Phenol are given by Dahms, 1895, Paterno and Ampola, 1897, Tsakalotos and Guye, 1910, and Rosza, 1911. Additional data on the system Benzene + Pyridine are given by Pickering, 1893.

SOLUBILITY OF BENZENE IN SULPHUR.

By "Synthetic Method," see Note, p. 16.

(Alexejew, 1886.)

t°.	Gms. C_6H_6 per 100 Gms.: S Layer.	C_6H_6 Layer.
100	6	75
110	8	72.5
120	10	70
130	12	66
140	16	61
150	19	55
160	25	45
164 (crit. temp.)	35	

SOLUBILITY DATA, DETERMINED BY THE FREEZING-POINT METHOD (see footnote, p. 1), ARE GIVEN FOR THE FOLLOWING MIXTURES:

Benzene + Benzoic acid	(Roloff, 1895. See Benzoic Acid, p. 135)
" + *o* Nitrobenzylchloride	(Schmidlin and Lang, 1912)
" + Bromoform	" "
" + Tetramethyldiamino benzhydrol	" "
" + Benzhydrol	" "
" + Nitrobenzene	(Dahms, 1895)
" + *o*, *m* and *p* Chloronitrobenzene	(Bogojawlensky, Winogradow and Bogolubow, (1906)
" + *m* Bromonitrobenzene	
" + *o*, *m* and *p* Dinitrobenzene	(Kremann, 1908)
" + Carbon disulfide	(Pickering 1893)
" + Camphene	(Kurnakoff and Efremoff, 1912)
" + *m* Cresol	(Kremann and Borjanovics, 1916)
" + Cyclohexane	(Mascarelli and Pestalozza, 1907, 1908)
" + Diphenyl	(Washburn and Read, 1915)
" + Diethylamine	(Pickering, 1893)
" + Diphenylamine	(Bruni, 1898, Dahms, 1895)
" + Ethyl ether	(Pickering, 1893)
" + Ethylene bromide	(Dahms, 1895)
" + Ethylene dibromide	(Baud and Gay, 1911)
" + Ethylene chloride	(Baud and Gay, 1910)
" + Ethylene dichloride	(Baud and Gay, 1911)
" + Menthol	(Dahms, 1895)
" + Methyl alcohol	(Pickering, 1893)
" + Naphthalene	(Bruni, 1898, Pickering, 1893, Washburn and Read, 1915)
" + " + β Naphthol	(Bruni, 1898)
" + " + Diphenylamine	"
" + Phenanthrene	"
" + " + Carbazol	"
" + Paraldehyde	(Paterno and Ampola, 1891, 1897)
" + *o*, *m* and *p* Nitrophenol	(Bogojawlensky, Winogradow and Bogolubow, 1906)
" + Propyl alcohol	(Pickering, 1893)
" + Quinine	(Van Iterson-Rotgans, 1913)
" + Thiophene	(Tsakalotos and Guye, 1910)
" + Bromotoluene	(Paterno and Ampola, 1897)
" + 1.2 4, 1 2 6 and 1.3.4 Dinitrotoluene	(Kremann 1908)
" + Urethan	(Pushin and Glagoleva and Mazarovich, 1914)
" + *p* Xylene	(Paterno and Ampola, 1897)
Bromobenzene + Chlorobenzene	(Pascal, 1913)
" + Iodobenzene	"
" + Fluorobenzene	"
p Dibromobenzene + *o* Dibromobenzene	(Holleman and van der Linden, 1911)
" + *p* Dichlorobenzene	(Bruni and Gorni, 1899; Kuster and Wurfel, 1904–05; Kruyt, 1912)
" + *p* Diiodobenzene	(Nagornow, 1911)
" + *p* Bromoiodobenzene	"
" + *p* Chlorobromobenzene	(Bruni and Gorni, 1899)
" + *p* Chloronitrobenzene	(Pawlewski, 1898)
" + *m* "	"
" + *p* Bromotoluene	(Borodowski and Bogojawlenski, 1904.)

SOLUBILITY OF *p* DIBROMOBENZENE IN SEVERAL SOLVENTS AT 25°
(Hildebrand, Ellefson and Beebe, 1917)

Solvent	Gms. $C_6H_4Br_2$ (*p*) per 100 Gms. Solvent	Solvent	Gms. $C_6H_4Br_2$ (*p*) per 100 Gms. Solvent
Methyl Alcohol	10.35	Carbon Tetrachloride	36.6
Benzene	83.8	Ethyl Ether	71.3
Carbon Disulfide	90	Hexane	25.9

DiBromo**BENZENE** (*p*) $C_6H_4Br_2$.

SOLUBILITY IN ETHYL, PROPYL, ISO BUTYL ALCOHOLS, ETC.
(Schroder — Z. physik. Chem. 11, 456, '93.)

Determinations by "Synthetic Method" see Note, p. 16.

t°.	Grams $C_6H_4Br_2$ (*p*) per 100 Grams Sat. Solution in C_2H_5OH.	C_3H_7OH.	$(CH_3)_2CH.CH_2OH$.	$(C_2H_5)_2O$.	CS_2.	C_6H_6	C_6H_5Br.
0	...	..	...	..	27	.	..
10	...	..	...	30	34	34	22
20	...	..	...	38	43	43	29
30	14	..	15	47	53	53	36
40	19	..	20	57	62	62	45
50	26	27	30	67	72	71	54
60	38	40	44	77	81	80	67
70	57.6	67	65	87	90	88	79
75	80.5	85	77	..	..	..	84
80	94.4	95	94.6	..	..	..	90

SOLUBILITY OF MIXTURES OF *p* DIBROMOBENZENE AND *p* DICHLOROBENZENE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL

Solvent, 50 Vol. % C_2H_5OH, $t = 49.1°$ (Kuster and Dahmer, 1905)			Solvent, 90.9 Vol. % C_2H_5OH, $t = 25°$ (Kuster and Wurfel, 1904–05)		
Gms. per 100 cc. Sat. Sol. $C_6H_4Br_2$	$C_6H_4Cl_2$	Mol. % $C_6H_4Br_2$ in Solute	Gms. per 100 cc. Sat. Sol. $C_6H_4Br_2$	$C_6H_4Cl_2$	Mol. % $C_6H_4Br_2$ in Solute
0.484	0	100	2.909	0	100
0.505	0.044	89.8	2.674	0.696	94.3
0.496	0.084	80.7	2.220	2.808	70.7
0.477	0.503	59.3	1.709	4.249	49.1
0.470	0.721	54.4	1.271	6.237	24.5
0.196	1.311	11.6	0.675	6.877	9.9
0	1.614	0	0	8.271	0

Additional data for the above system are given by Thiel (1903).

Tribromo **BENZENE,** $C_6H_3Br_3$. Solubility, gms. per 100 gms. at 20–25°: In H_2O, 0.004, in pyridine, 24.3, in Aq. 50% pyridine, 2.01. (Dehn, 1917.)

SOLUBILITY DATA, DETERMINED BY THE FREEZING-POINT METHOD (see footnote, p. 1), ARE GIVEN FOR THE FOLLOWING MIXTURES.

p Bromochlorobenzene	+ *p* Dichlorobenzene	(Bruni and Garni, 1899.)
"	+ *o* Bromochlorobenzene	(Holleman and Van der Linden, 1911.)
p Bromoiodobenzene	+ *p* Diiodobenzene	(Nagornow, 1911.)
o Bromonitrobenzene	+ *o* Chloronitrobenzene	(Kremann, Kremann and Ehrlich, 1908.)
"	+ *p* Bromonitrobenzene	(Holleman & de Bruyn, 1900, Narbutt, '05.)
m "	+ *o* "	(Narbutt, 1905.)
"	+ *p* "	"
"	+ *m* Chloronitrobenzene	(Hasselblatt, 1913, Kuster, 1891.)
"	+ *m* Iodonitrobenzene	(Hasselblatt, 1913.)
"	+ *m* Fluoronitrobenzene	"
"	+ *m* Chloronitrobenzene	(Kremann, 1908.)
"	+ *p* "	(Kremann, 1908, Isaac, 1913, Kremann & Ehrlich, 1908.)

ChloroBENZENE C_6H_5Cl.

SOLUBILITY OF CHLOROBENZENE IN SULPHUR.

"Synthetic Method," see page 16.

(Alexejew.)

t°.	Grams C_6H_5Cl per 100 Grams. Sulphur Layer.	Chlor Benzene Layer.
90	13	70
100	18.5	63
110	27	53
116 crit. temp.	38	

*p*DichloroBENZENE, $C_6H_4Cl_2$. *o* and *m* ChloronitroBENZENE, $C_6H_4ClNO_2$.

SOLUBILITY OF EACH IN LIQUID CARBON DIOXIDE.

(Buchner, 1905–06.)

p Dichlorobenzene. t°.	Gms. *p* $C_6H_4Cl_2$ per 100 Gms. Sat. Solution.	*o* Chloronitrobenzene. t°.	Gms *o* $C_6H_4ClNO_2$ per 100 Gms. Sat. Solution.	*m* Chloronitrobenzene. t°.	Gms. *m* $C_6H_4ClNO_2$ per 100 Gms Sat. Solution
−33	1.2	−32	1	− 1	1.8
−10	4.2	+ 5	7.8	+16.5	11.2
+10	11.4	7	16.5–36 quad. pt.	7.5	38.2 quad. pt.
20	22.7	8	58.8	20	53.2
22	34.4	11	65.8		

SOLUBILITY OF *o*, *m* AND *p* CHLORONITROBENZENES IN ANILINE, DETERMINED BY THE FREEZING-POINT METHOD (see also p. 77).

(Kremann, 1907)

t°.	Gms. Each Compound (Determined Separately) per 100 Gms. Sat. Sol. *o* $C_6H_4ClNO_2$	*m* $C_6H_4ClNO_2$	*p* $C_6H_4ClNO_2$
−10	43 19 (=31 Mol. %)	21 60 (=14 Mol. %)	27 75 (=18 5 Mol. %)
− 2 5	51 30 (=39 "	31.67 (=21.5 "	31.67 (=21.5 "
+10	69.15 (=57 "	49.29 (=36.5 "	38.50 (=27 "

SOLUBILITY DATA, DETERMINED BY THE FREEZING-POINT METHOD (see footnote, p. 1), ARE GIVEN FOR THE FOLLOWING MIXTURES:

Chlorobenzene + Iodobenzene	(Pascal, 1913)
" + Cyanbenzene	"
" + Fluorobenzene	"
o Dichlorobenzene + *p* Dichlorobenzene	(Holleman and Van der Linden, 1911.)
p " + *p* Diiodobenzene	(Nagornow, 1911)
+ *p* Chloroiodobenzene	"
1.2.4 Trichlorobenzene + 1.2.3 Trichlorobenzene	(Van der Linden, 1912.)
" + 1.3.5 "	"
" + " " + 1.2.3 Trichlorobenzene	"
α Hexachlorobenzene + *β* Hexachlorobenzene	"
p Chloroiodobenzene + *p* Diiodobenzene	(Nagornow, 1911)
o Chloronitrobenzene + *p* Chloronitrobenzene	(Holleman and de Bruyn, 1900.)
" + "	(Bogajawlewsky, Winogradow and Bogolubow, 1906.)
" + Formic acid	(Bruni and Berti, 1900.)
m " + *m* Iodonitrobenzene	(Hasselblatt, 1913.)
" + *m* Fluoronitrobenzene	"
" + Naphthalene	(Kremann and Rodenis, 1906.)
p " + Diphenylamine	(Tinkler, 1913.)
" + Naphthalene	(Kremann and Rodenis, 1906.)
o Iodonitrobenzene + *p* Iodonitrobenzene	(Holleman, 1913.)
m Benzene disulfone chloride + *p* Benzene disulfone chloride.	(Holleman and Pollak, 1910.)

Mutual Solubility of Nitrobenzene and Water
(Campetti and Del Grosso, 1913; Davis, 1916)

t°.	Gms. $C_6H_5NO_2$ per 100 Gms. H₂O Layer.	Gms. $C_6H_5NO_2$ per 100 Gms. $C_6H_5NO_2$ Layer.	t°.	Gms. $C_6H_5NO_2$ per 100 Gms. H_2O Layer.	Gms. $C_6H_5NO_2$ per 100 Gms. $C_6H_5NO_2$ Layer.
20	0.19	99.76	180	4.2	93.7
40	0.3	99.6	200	7.2	91
60	0.4	99.3	220	11.8	87
80	0.8	99	230	15.8	83
100	1	98.7	240	23	72
120	1.3	98.2	241	26	67
140	1.9	97.2	242	32	58
160	2.8	95.8	244.5	crit. t.	50.1

Data for the solubility of nitrobenzene in hexane, diisoamyldecane and American petroleum at pressures up to 3000 atmospheres, are given by Kohnstamm and Timmermans (1913).

Solubility of *o*, *m* and *p* Nitrobenzene in Water and in Pyridine.
(Dehn, 1917)

Solvent.	t°.	Gms. Each Compound Separately per 100 Gms. Solvent. *o* Nitrobenzene.	*m* Nitrobenzene.	*p* Nitrobenzene.
Water	20–25	0.21+	2.14+	1.32+
50% Aq. Pyridine	20–25	173	two layers formed	85.3
Pyridine	20–25	260	394	53.2

Solubility Data, Determined by the Freezing-point Method (see footnote, p. 1), Are Given for Mixtures of Nitrobenzene and Each of the Following Compounds:

Ethyl Ether	(Tsakalotos and Guye, 1910)	Mercuric Bromide	(Mascarell and Ascoli, 1907)
Hexane	(Timmermans, 1907, 1911.)	Mercuric Chloride	" "
Hexane + Resorcine	(Timmermans, 1907.)	Nitrosobenzene	(Jaeger and van Kregten, 1912.)
Isopentane	(Timmermans, 1910, 1911)	Phenol	(Dahms, 1895.)
Diethyldiacetyltartrate	(Scheuer, 1910)	Ethylene Bromide	"
Menthol	"	Naphthalene	(Kremann, '04; Kurnakov, et al, '15.)

DiNitroBENZENE (*m*) $C_6H_4(NO_2)_2$.

Solubility in Benzene, Brom Benzene and in Chloroform.
"Synthetic Method."
(Schröder)

t°.	Gms $C_6H_4(NO_2)_2$ per 100 Gms Sol in: C_6H_6	C_6H_5Br	$CHCl_3$	t°.	Gms. $C_6H_4(NO_2)_2$ per 100 Gms Sol in. C_6H_6	C_6H_5Br	$CHCl_3$
15	17.5	...	22.2	40	52.0	38.0	42.0
20	26.0	18.5	25.0	50	62.5	47.5	52.5
25	33.0	23.7	29.0	60	71.0	57.0	65.0
30	40.0	28.7	33.0	.	...	...	...

Solubility of *m* Dinitrobenzene in Several Alcohols and Acids
(Timofeiew, 1894)

Solvent.	t°.	Gms *m* $C_6H_4(NO_2)_2$ per 100 Gms. Sat Sol.	Solvent.	Solvent	t°.	Gms. *m* $C_6H_4(NO_2)_2$ per 100 Gms. Sat. Sol	Solvent.
CH_3OH	13.8	5.38	5.65	CH_3COOH	15.5	15.7	18.6
C_2H_5OH	13.8	2.83	2.92	"	23	17.8	21.6
C_3H_7OH	13.8	2	2	C_2H_5COOH	13.5	12	13.6
C_3H_7OH	73	43.6	77.3	"	15.5	12.9	14.8
HCOOH	13.5	9	9.9	"	23	13.45	15.5
HCOOH	15.5	9.6	10.5	C_3H_7COOH	13.5	7.3	8.3
CH_3COOH	13.5	15.2	17.9	"	15.5	8.2	8.9

100 gms. 95% formic acid dissolve 11.89 gms. *m* dinitrobenzene at 20.8°. (Aschan, '13).
100 gms. pyridine dissolve 106.3 gms. *m* dinitrobenzene at 20°–25°. (Dehn, 1917.)
100 gms. 50% aq. pyridine dissolve 45.5 gms. *m* dinitrobenzene at 20°–25°. "

Solubilities of Di-Nitro **BENZENES** and of Tri-Nitro **BENZENES** in Several Solvents.

(de Bruyn — Rec. trav. chim. 13, 116, 150, '94.)

Solvent.	t°.	Grams per 100 Grams Solvent. $(o)C_6H_4.(NO_2)_2$.	$(m)C_6H_4.(NO_2)_2$.	$(p)C_6H_4.(NO_2)_2$.	$(s)C_6H_3.(NO_2)_3$.	$(as)C_6H_3(NO_2)_3$.
Methyl Alcohol	20.5	3.30	6.75	0.69	4.9 (16°)	16.2 (15.5°)
Ethyl Alcohol	20.5	1.9	3.5	0.4	1.9 (16°)	5.45 (15.5°)
Propyl Alcohol	20.5	1.09	2.4	0.298	...	...
Carbon Bi-Sulphide	17.6	0.236	1.35	0.148	0.25	...
Chloroform	17.6	27.1	32.4	1.82	6.1	...
Benzene	18.2	5.66	39.45	2.56	6.2 (16°)	...
Ether	17.5	...	...	...	1.5	...
Ethyl Acetate	18.2	12.96	36.27	3.56	...	...
Toluene	16.2	3.62	30.66	2.36	...	...
Carbon Tetra Chloride	16.2	0.143	1.18	0.12	...	...
Water	(ord.)	0.014	0.0525	0.008	...	...

Symmetrical Tri-Nitro **BENZENE**.

SOLUBILITY IN AQUEOUS ALCOHOL AT 25°.

(Holleman and Antusch — Rec. trav. chim. 13, 296, '94.)

Vol. % Alcohol.	G. $C_6H_3(NO_2)_3(s)$ per 100 g. Solvent.	Sp. Gr. of Solutions.	Vol % Alcohol.	G. $C_6H_3(NO_2)_3(s)$ per 100 g. Solvent.	Sp. Gr. of Solutions.
100	2.34	0.7957	80	0.57	0.8582
95	1.57	0.8131	75	0.47	0.8708
90	1.12	0.8288	70	0.37	0.8808
85	0.79	0.8436	60	0.23	0.9064

See remarks under α Acetnaphthalide, p. 13.

100 gms. 93 vol. % ethyl alcohol dissolve 2.1 gms. of *o* $C_6H_4(NO_2)_2$, 3.1 gms. *m* $C_6H_4(NO_2)_2$ and 0.33 gm. *p* $C_6H_4(NO_2)_2$ at 25°. (Holleman and de Bruyn, 1900.)

100 gms. of each of the following solvents dissolve the indicated gms. of 1.2.4 trinitrobenzene at 15.5°: C_6H_6, 140.8 gms.; $CHCl_3$, 12.87 gms.; CH_3OH, 12.08 gms.; $(C_2H_5)_2O$, 7.13 gms.; C_2H_5OH, 5.42 gms; CS_2, 0.4 gm. (de Bruyn, 1890.)

Data for the solubility of *m* dinitrobenzene in a solution of nitrobenzene in hexane are given by Timmermans (1907).

Solubility data, determined by the freezing-point method, are given for mixtures of *o*, *m* and *p* dinitrobenzene with fluorene, Kremann (1911); with phenanthrene, Kremann, *et al* (1908). Results for mixtures of *o* and *p* dinitrobenzene with naphthalene, by Kremann and Rodinis (1906). Data for *m* dinitrobenzene with nitrotoluenes are given by Giua (1915) and for *m* dinitrobenzene and diphenylamine by Giua (1915a). Similar data for mixtures of *s* trinitrobenzene with xanthone, quinol, dimethylpyrone, *s* tribromophenol, fluorenone, coumarine, and phenyl ether are given by Sudborough and Beard (1911). Results for *s* trinitrobenzene and γγ dipyridyl are given by Smith and Watts (1910) and for *s* trinitrobenzene and fluorene by Kremann (1911). Results for mixtures of *m* dinitrobenzene and naphthalene and for 1.3.5 trinitrobenzene and naphthalene are given by Kremann, (1904) and Kurnakov, Krotkov and Oksman (1915).

BENZYHYDROL $(C_6H_5)_2CHOH$.

Solubility data, determined by the freezing-point method (see footnote, p. 1), are given for mixtures of benzhydrol and phenol and for benzhydrol and dimethylaniline by Schmidlin and Lang (1912).

BENZIL $C_6H_5CO.COC_6H_5$.

Data for the solubility of benzil in aqueous ethyl alcohol are given by Timmermans (1907) and by Kendall and Gibbons (1915). Data for aqueous solutions of benzil and phenol, for benzil and succinic acid nitrile and for benzil and triethyl amine are given by Timmermans (1907).

SOLUBILITY DATA, DETERMINED BY THE FREEZING-POINT METHOD (see footnote, p. 1), ARE GIVEN FOR THE FOLLOWING MIXTURES:

Benzil + Dibenzyl	(Vanstone, 1913)
" + Azobenzene	"
" + Stilbene	"
" + Hydrobenzoin	"
" + Benzoin	(Beurath, 1912–13; Vanstone, 1909)
" + Benzoic acid	(Kendall and Gibbons, 1915.)

BENZINE (Petroleum) $C_5H_{12}C_6H_{14}$.

100 parts of alcohol dissolve about 16 parts benzine of 0.638 — 0.660 Sp. Gr., at 25°.

BENZOIC ACID C_6H_5COOH.

SOLUBILITY IN WATER.

(Bourgoin — Ann. chim. phys. [5] 15, 171, '78)

t°.	Grams. C_6H_5COOH per 100 Gms. Water.	Grams. C_6H_5COOH per 100 Gms. Solution.	t°.	Grams. C_6H_5COOH per 100 Gms. Water.	Grams. C_6H_5COOH per 100 Gms. Solution.
0	0.170	0.170	40	0.555	0.551
10	0.210	0.209	50	0.775	0.768
20	0.290	0.289	60	1.155	1.142
25	0.345	0.343	80	2.715	2.643
30	0.410	0.408	100	5.875	5.549

100 grams saturated aqueous solution contain 0.25 gm. C_6H_5COOH at 15°; 0.3426 gram at 25°; 0.353 gram at 26.4°; 0.667 gram at 45°; 5.875 gms. at 100°.

(Paul, 1894; Noyes and Chapin, 1898, Greenish and Smith, 1903, Hoffman and Langbeck, 1905; Lumsden, 1905; Philip, 1905, see also Alexejew, 1886, Ost, 1878; Vaubel, 1895, Freundlich and Seal, 1912)

SOLUBILITY OF MIXTURES OF LIQUID BENZOIC ACID AND WATER.

(Alexejew)

Determinations by "Synthetic Method," see Note, p. 16. Figures read from curve.

t°.	Gms. C_6H_5COOH per 100 Gms. Aq. Layer.	Gms. C_6H_5COOH per 100 Gms. Benzoic Ac. Layer.	t°.	Gms. C_6H_5COOH per 100 Gms. Aq. Layer.	Gms. C_6H_5COOH per 100 Gms. Benzoic Ac. Layer.
70	6	83	100	12.0	69.0
80	7.5	79.5	110	18.0	59.0
90	8.5	76	116 (crit. temp.)	35	

SOLUBILITY OF BENZOIC ACID IN AQUEOUS SOLUTIONS OF:

(Hoffman and Langbeck.)

Potassium Chloride at 25°.

Normality of Aq. KCl.	Gms. KCl. per Liter.	Dissolved C_6H_5COOH. Mol. Conc.	Dissolved C_6H_5COOH. Wt. per cent.
0.02	1.49	$5.0254-10^{-4}$	0.339
0.05	3.73	4.9801 "	0.333
0.20	14.92	4.7639 "	0.322
0.50	37.30	4.3632 "	0.295

Potassium Nitrate at 25°.

Normality of Aq. KNO_3	Gms. KNO_3 per Liter	Dissolved C_6H_5COOH. Mol. Conc.	Dissolved C_6H_5COOH. Wt. per cent.
0.02	2.02	$5.0326-10^{-4}$	0.340
0.05	5.06	5.0421 "	0.341
0.20	20.24	5.0297 "	0.340
0.50	50.59	4.9400 "	0.334
1.00	101.19	4.7646 "	0.322

SOLUBILITY OF BENZOIC ACID IN AQUEOUS SOLUTIONS OF:

(Hoffmann and Langbeck.)

Sodium Chloride.

Normality of Aq. NaCl.	Gms. NaCl per Liter.	Gms. C_6H_5COOH per 100 Gms. Sol. at 25°.	at 45°.
0.00	0.00	0.340	0.667
0.02	1.17	0.339	0.663
0.05	2.93	0.335	0.654
0.20	11.70	0.336	0 617
0.50	29.25	0.282	0 546
1.00	58.50	...	0.449

Sodium Nitrate.

Normality of Aq NaNO₃	Gms. $NaNO_3$ per Liter.	Gms. C_6H_5COOH per 100 Gms. Sol. at 25°.	at 45°.
0.02	1.70	0.340	0.666
0.05	8.51	0.339	0.663
0.20	17.02	0.333	0.647
0.50	42.54	0.319	0.613
1.00	85.09	0.294	...

SOLUBILITY OF BENZOIC ACID IN AQUEOUS SOLUTIONS OF SODIUM ACETATE, FORMATE, BUTYRATE, AND SALICYLATE.

(Noyes and Chapin — Z. physik. Chem. 27, 443, '98; Philip — J. Ch. Soc. 87, 992, '05.)

Grams Sodium Salt per Liter.	Grams C_6H_5COOH per Liter of Solution in:					
	CH_3COONa.		$HCOONa$.		C_3H_7COONa.	$C_6H_4OH.COONa$.
	At 25°.	At 26.4°.	At 25°.	At 26.4°.	At 26.4°.	At 26.4°.
0	3.41	3.53	3.41	3.53	3.53	3.53
1	4.65	4.75	4.25	4.35	4.50	3.62
2	5.70	5.85	4.75	4.85	5.40	3.70
3	6.70	6.90	5.20	5.30	6.15	3.80
4	7.60	7.85	5.60	5.70	6.90	3.87
6	...	...	...	...	8.40	4.00
8	...	...	...	...	...	4.10

SOLUBILITY OF BENZOIC ACID IN AQUEOUS SOLUTIONS OF SODIUM MONOCHLORACETATE, SODIUM SUCCINATE AND POTASSIUM FORMATE AT 25°.

(Philip and Garner, 1909.)

In Aq. $CH_2ClCOONa$. Gms per Liter Solution		In Aq. $(CH_2COONa)_2$. Gms per Liter Solution		In Aq. $HCOOK$. Gms per Liter Solution.	
$CH_2ClCOONa$	C_6H_5COOH.	$(CH_2COONa)_2$	C_6H_5COOH.	$HCOOK$.	C_6H_5COOH.
0	3.38	0	3.38	0	3.38
1.375	3.684	1.182	4.087	1.025	4.087
3.426	4.026	2.932	5.112	2.563	4.734
6.839	4.417	5.848	6.564	5.124	5.503
13.710	4.929	11.730	9.005		

The authors also obtained data for the solubility of benzoic acid in aqueous solutions of sodium acetate and sodium formate which agree closely with those quoted in the second table above.

100 cc. 90% ethyl alcohol dissolve 36.1 gms. C_6H_5COOH at 15.5°. (Greenish & Smith, '03.)

100 cc. of a 1.0 *n* aqueous solution of aniline hydrochloride dissolve 0.537 gm. C_6H_5COOH at 25°. (Sidgwick, 1910.)

SOLUBILITY OF BENZOIC ACID IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°.

(Seidell, 1908, 1910.)

Wt. % C_2H_5OH in Solvent.	Sp. Gr. of Sat. Sol.	Gms. per 100 Gms Sat. Sol C_2H_5OH.	C_6H_5COOH.	Wt. % C_2H_5OH in Solvent.	Sp. Gr. of Sat. Sol.	Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	C_6H_5COOH.
0	1	0	0.367	60	0.943	45.72	23.80
10	0.985	9.94	0.60	70	0.940	49.21	29.70
20	0.970	19.66	1.70	80	0.934	52.8	34
30	0.959	28.83	3.90	90	0.922	57.6	36
40	0.951	36.36	9.10	100	0.908	63.1	36.9
50	0.946	41.50	17				

SOLUBILITY OF BENZOIC ACID IN 90% ALCOHOL, IN ETHER AND IN CHLOROFORM.
(Bourgoin.)

Solvent.	t°.	Gms. C_6H_5COOH per 100 Grams.	
		Solvent.	Solution.
90% Alcohol	15	41.62	29.39
Ether	15	31.35	23.86
Chloroform	25	14.30	12.50

SOLUBILITY OF BENZOIC ACID IN SEVERAL ALCOHOLS. (Timofeiew, 1894.)

Alcohol.	t°.	Gms. C_6H_5COOH per 100 Gms Sat. Sol.	Solvent	Alcohol	t°.	Gms C_6H_5COOH per 100 Gms. Sat. Sol.	Solvent
Methyl	−18	23.1	30	Propyl	−18	14.5	16.9
"	−13	24.3	32.1	"	−13	15.7	18.5
"	+3	33.5	50.4	"	+3	23.1	30
"	19.2	40.1	67.1	"	19.2	28.2	39.3
"	23	41.7	71.5	"	23	29.8	42.3
Ethyl	−18	20.3	25.4	Isopropyl	21.2	32.7	48.5
"	−13	21.2	26.9	Allyl	21.2	25.1	33.4
"	+3	28.8	40.4	Isobutyl	0	15.3	18
"	19.2	34.4	52.4	Isoamyl	18	20.2	25.4
"	23	35.9	55.9	Capryllic	21.2	22.7	28.7
				Ethyleneglycol	18	8	8.69

Additional data, agreeing closely with the above, are given by Timofeiew (1891) and Bourgoin (1878).

SOLUBILITY OF BENZOIC ACID IN AQUEOUS SOLUTIONS OF DEXTROSE.
(Hoffman and Langbeck.)

Normality of Aq. Dextrose.	Gms. $C_6H_{12}O_6$ per Liter.	Dissolved C_6H_5COOH at 25°. Mol. Conc.	Weight Per Cent.	Dissolved C_6H_5COOH at 45°. Mol. Conc.	Weight Per Cent.
0.02	3.67	$5.0322 \cdot 10^{-4}$	0.34	$9.9088 \cdot 10^{-4}$	0.674
0.05	9.00	5.0403 "	0.34	9.9328 "	0.669
0.204	36.73	5.0303 "	0.34	9.9323 "	0.669
0.533	96.15	5.0321 "	0.34	10.0101 "	0.674
1.068	192.30	5.0443 "	0.341	10.0369 "	0.676

SOLUBILITY OF BENZOIC ACID IN AQUEOUS SOLUTIONS OF UREA AND OF THIO UREA.
(Hoffman and Langbeck.)

	Normality of Solution.	Gms. per Liter.	C_6H_5COOH Dissolved at 25°. Mol. Conc.	Wt. per cent.
In Aqueous Urea	0.10	6.01 $CO(NH_2)_2$	$5.1876 \cdot 10^{-4}$	0.350
In Aqueous Thio Urea	0.20	15.23 $CS(NH_2)_2$	5.4994 "	0.372

Data for the system benzoic acid, succinic acid nitrile and water are given by Schreinemakers, 1898, and for the system benzoic acid, phenol and water by Timmermanns, 1907.

SOLUBILITY OF BENZOIC ACID IN BENZENE AND VICE VERSA. (Roloff, 1895.)

t°.	Gms C_6H_5COOH per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. C_6H_5COOH per 100 Gms Sat Sol.	Solid Phase.
5.37	0	C_6H_6	20	8.8	C_6H_5COOH
5	1.75	"	30	13	"
4.50	3.95	"	50	25	"
4.20	5	$C_6H_6+C_6H_5COOH$	70	43.5	"
5	5.05	C_6H_5COOH	90	64	"
7	5.50	"	110	91.5	"
9	5.70	"	121	100	"
11	6	"			

Von Euler and Löwenhamn (1916) found 7.76 gms. C_6H_5COOH per 100 cc. of sat. solution in benzene at 25°, and 7.76 gms. C_6H_5COOH + 2.50 gms. $C_6H_4OHCOOH$ *o* per 100 cc. of benzene solution saturated with both acids.

Solubility of Benzoic Acid in Organic Solvents.

Solvent.	t°.	Gms. C_6H_5COOH per 100 cc. Sat. Sol.	Solvent.	t°.	d_{25} of Sat. Solution.	Gms. C_6H_5COOH per 100 Gms. Sat. Sol.
Aq. 75% Acetic Acid	14–16	10.92 (1)	Amyl Alcohol	25	0.875	32.37 (6)
Benzene	14–16	7.04 (1)	Amyl Acetate	25	0.912	22 (6)
Carbon Disulfide	14–16	4.24 (1)	Alcohol (Abs.)	25	0.908	58.40 (6)
Carbon Tetrachloride	14–16	4.50 (1)	Benzene	25	0.897	12.23 (6)
"	25	6.70 (2)	Chloroform	25	1.456	15.14 (6)
"	26	6.58 (3)	Carbon Tetrachloride	25	1.564	4.18 (6)
Chloroform	25	18.03 (2)	Carbon Disulfide	25	1.282	4.82 (6)
Ethyl Ether	14–16	39.80 (1)	Cumene	25	0.906	8.59 (6)
Glycerol	15–16	9.07*(4)	Ethyl Ether (Abs.)	25	...	46.74 (6)
Ligroin	14–16	0.72 (1)	Ligroin	25	0.720	1.75 (6)
Petroleum Ether †	26	0.98 (3)	Naphtha	25	0.730	2.65 (6)
Pentachlor Ethane	25	10.92 (2)	Nitrobenzene	25	1.225	10.05 (6)
Tetrachlor Ethane	25	15.17 (2)	Toluene	25	0.884	10.69 (6)
Tetrachlor Ethylene	25	8.06 (2)	Spts. Turpentine	25	0.859	5.09 (6)
Trichlor Ethylene	25	13.62 (2)	Water	25	1	0.368(6)
"	15	6.44*(5)	Xylene	25	0.877	9.71 (6)
Dichlor Ethylene	15	9.67*(5)				

* = Gms. C_6H_5COOH per 100 gms. sat. sol. † (B. pt. 30–70)

(1) Bornwater and Holleman (1912); (2) Herz and Rathmann (1913); (3) de Jong (1909); (4) Ossendowski (1907); (5) Wester and Bruins (1914); (6) Seidell (1910).

One liter sat. sol. of benzoic acid in ethyl acetate contains 8 gms. at −6.5°, 37.7 gms. at 21.5° and 95.7 gms. at 75°. (Lloyd, 1918)

Solubility of Benzoic Acid in Mixtures of Organic Solvents at 25°.

(Marden and Dover, 1916.)

Mixtures of Ether + Chloroform.		Mixtures of Acetone + Benzene.		Mixtures of Ethyl Acetate + Benzene.	
% $CHCl_3$* in Solvent.	Gms. C_6H_5COOH per 100 Gms. Solvent.	% C_6H_6 in Solvent.	Gms. C_6H_5COOH per 100 Gms. Solvent.	% C_6H_6 in Solvent.	Gms. C_6H_5COOH per 100 Gms. Solvent.
100	38.4	100	11.6	100	11.6
90	34	90	18.3	90	14
80	30.1	80	24.1	80	16.5
70	26.6	70	31	70	20
60	23.2	60	33.5	60	20.4
50	20.8	50	37	50	22
40	18.6	40	42.2	40	23.9
30	16.8	30	47	30	26.5
20	15.6	20	49	20	29
10	15.2	10	51.3	10	28.2
0	15.0	0	55.6	0	41.2

* This is probably a mistake in the original and should be $\%(C_2H_5)_2O$ in Solvent.

Solubility Data, Determined by the Freezing-point Method (see footnote, p. 1), are Given for Mixtures of Benzoic Acid and Each of the Following Compounds:

o Chlorobenzoic Acid, *m* " ", *p* " " (Bornwater and Holleman, 1912.)
m Nitrobenzoic Acid (Bakunin and Angrisani, 1915.)
Benzil (Kendall and Gibbons, 1915.)
Camphor (Journiaux, 1912)
Cinnamic Acid (Kachler, 1870; Kendall, 1914.)
Dimethylpyrone (Kendall, 1914.)
Fluorobenzoic Acid (Koopal, 1911.)
Piperonal (Kendall and Gibbons, 1915.)
Pyridine (Baskov, 1914.)
Salicylic Acid (Jaeger, 1907.)
Succinic Acid Nitrile (Schreinemakers, 1898.)
Sulfuric Acid (Kendall and Carpenter, 1914.)
o Toluic Acid (Kendall, 1914.)
o Toluidine (Baskov, 1913.)
p " (Baskov, 1913; Vignon, 1891.)

Distribution of Benzoic Acid Between Water and Benzene:

At 10°. (Hendrixon, 1897.) Gms. C_6H_5COOH per 100 cc.		At 20°. (Nernst, 1891.) Gms. C_6H_5COOH per 100 cc.		At 25°. (Farmer, 1903.) Gms. C_6H_5COOH per 100 cc.		At 40°. (Hendrixon, 1897.) Gms. C_6H_5COOH per 100 cc.	
H_2O. Layer.	C_6H_6 Layer.	H_2O. Layer.	C_6H_6. Layer.	H_2O Layer.	C_6H_6 Layer.	H_2O Layer.	C_6H_6 Layer.
0.0215	0.0725	0.0163	0.0535	0.2002 (0.1885*)	3.335	0 0238	0 0714
0.0412	0.2363	0.0244	0.099	0.2012 (0.1891*)	3.329	0.0404	0.1637
0.0562	0.4422	0.0452	0.273	0.2020 (0.1902*)	3.319	0 0837	0 5740
0.0890	1.0889	0.0788	0.737			0.1155	1.0269
0.1215	2.0272	0.1500	2.42			0.1715	2 1420
0.1409	2.7426	0.2890	9.70			0.2313	3 9167

* = unionized.

Distribution of Benzoic Acid Between Benzene and Aqueous Potassium Benzoate Solutions at 25°.

(Farmer, 1903)

Gms. Mols. C_6H_5COOK per Liter Aq. Sol.	Gm. Mols. C_6H_5COOH per Liter. Aq. Layer.	Gm. Mols. C_6H_5COOH per Liter. C_6H_6 Layer.	Gms. C_6H_5COOK per Liter Aq. Sol.	Gms. C_6H_5COOH per liter. Aq. Layer.	Gms. C_6H_5COOH per liter. C_6H_6 Layer.
0.0093	0.01587	0.2776	1.341	1.937	33.88
0.028	0.01597	0.2768	4.035	1.950	33.79
0.047	0.01603	0.2762	6.774	1.956	33.71

Distribution of Benzoic Acid Between:

Water and Chloroform. (Hendrixon, 1897) At 10°. Gms. C_6H_5COOH per 100 cc		At 40°. Gms. C_6H_5COOH per 100 cc.		Water and CCl_4. (Seidell, 1910a.) At 25°. Gms. C_6H_5COOH per 100 cc.	
H_2O Layer.	C_6H_6 Layer.	H_2O Layer.	C_6H_6 Layer.	H_2O Layer.	CCl_4 Layer.
0.0208	0.0915	0.0258	0.0880	0.134	0.830
0.0269	0.1518	0.0432	0.2059	0.291	4.41
0.0327	0.2170	0.0885	0.6961		
0.1057	2.0930	0.1553	2.0435		

The coefficient of distribution of benzoic acid between olive oil and water at 25° is given by Boeseken and Waterman (1911) as 12.6.

Amino**BENZOIC ACID** (*o*) $C_6H_4.NH_2.COOH$.

Solubility of *o* Aminobenzoic Acid in Water. (Lunden, 1905–06.)

t°.	Sp Gr. Sat. Sol.	Gms. $C_6N_4NH_2COOH(o)$ per 100 cc. Sat. Sol.	t°.	Sp. Gr. Sat Sol.	Gms. $C_6H_4NH_2COOH(o)$ per 100 cc. Sat. Sol.
25	0.999	0.519	34.9	0.998	0.731
26.1	...	0.540	35	0.997	0.744
28.1	...	0.570	39.8	0.997	0.889

Solubility of Aminobenzoic Acid in Aqueous Salt Solutions at 25°.

(Lunden, 1905–06)

Normality of Salt Solution.	Sp. Gr. Sat. Solution.	Gms. $C_6H_4NH_2COOH(o)$ per 100 cc. Sat. Solution.	Normality of Salt Solution.	Sp. Gr. Sat. Solution.	Gms. $C_6H_4NH_2$-$COOH(o)$ per 100 cc. Sat. Sol.
0.768 $\frac{1}{2}Ba(NO_3)_2$	1.080	0.634	2.633 KNO_3	1.155	0.501
0.507 "	1.052	0.603	1.372 "	1.083	0.544
0.3427 "	1.037	0.585	0.598 "	1.033	0.549
0.1780 "	1.018	0.555	1.853 KI	1.221	0.541
0.1545 "	1.015	0.549	0.946 "	1.114	0.559
			0.560 "	1.068	0.556

The author also gives additional data for aqueous salt solutions at 28.1°.

Additional data for the solubility of aminobenzoic acid in aqueous salt solutions are given by Euler (1916).

AminoBENZOIC ACID $C_6H_4.NH_2.COOH$ (*m*).

SOLUBILITY IN WATER AND IN OTHER SOLVENTS.

(de Coninck — Compt. rend. 116, 758, '93.)

In Water.

t°.	Gms. $C_6H_4.NH_2.COOH(m)$ per 100 cc. H_2O.
0	0.43
10	0.52
20	0.67
30	0.87
40	1.15
50	1.50
60	2.15
70	3.15

In Organic Solvents.

Solvent.	t°.	Gms. $C_6H_4.NH_2.COOH(m)$ per 100 cc. Solvent.
Ethyl Alcohol (95%)	12.5	2.92
Methyl Alcohol (pure)	10.5	4.05
Acetone	11.3	6.22
Methyl Iodide	10.0	0.04
Ethyl Iodide	0.0	0.02
Chloroform	12.0	0.07
Bromoform	8.0	trace

MUTUAL SOLUBILITY OF AMINOBENZOIC ACIDS AND WATER AT HIGH TEMPERATURES, DETERMINED BY THE SYNTHETIC METHOD.

(Flaschner and Rankin, 1910.)

Mixtures of *o* Acid and H_2O.		Mixtures of *m* Acid and H_2O.		Mixtures of *p* acid and H_2O.	
t° of Melting.	Gms *o* Acid per 100 Gms. Mixture.	t° of Melting.	Gms. *m* Acid per 100 Gms. Mixture.	t° of Melting.	Gms. *p* Acid per 100 Gms. Mixture
83.6	4.8	66 crit. sol. temp.		47 crit. sol. temp.	
95.8	9.9	77.8	4.6	82.2	5
101.4	18.5	90	5.8	90	7.1
103.4	30.6	100	9.7	100	15.8
104.4	38	110	20.2	105	22
105	49.4	120	51.2	110	32.3
105.6	59.4	130	73.7	116	51.8
107.8	69.7	140	83.7	120	62
112	80	150	90.7	130	77
116.2	87.2	160	95.8	150	91.1
128.4	95	170	99.2	170	98
144.6	100	174.4	100	186	100

t° reading, for critical saturation and for separating, also given in the case of the *o* acid.

Data for the distribution of *o* aminobenzoic acid between water and benzene at 25° are given by Farmer and Warth (1904).

AminonitroBENZOIC ACIDS $C_6H_3.NO_2.NH_2.COOH$ *o*, *m* and *p*.

SOLUBILITY OF THE THREE ISOMERIC AMINONITROBENZOIC ACIDS:

In Ether.

t°.	Gms. $C_6H_3.NO_2.NH_2.COOH$ per 100 cc Ether. Ortho.	Meta.	Para.
2.7	10.84	1.70	6.41
5.8	16.05 (6.8°)	1.81	8.21

In Ethyl Alcohol (90%).

t°.	Gms. $C_6H_3NO_2.NH_2$ COOH per 100 cc Alcohol. Ortho.	Meta.	Para.
3	8.13	1.79	8.4
9.6	10.70	2.20	11.3

SOLUBILITY IN WATER OF THE THREE ISOMERIC:

(Vaubel, 1895.)

Aminobenzo Sulphonic Acids.

t°.	G. $C_6H_4.NH_2.SO_3H$ per 100 G. Aq. Sol. Ortho.	Meta.	Para.
7	1.06	1.276	0.592 (6°)

Amino Phenols.

t°.	G. $C_6H_4(OH).NH_2$ per 100 G. Aq. Sol. Ortho.	Meta.	Para.
0	1.7	2.6 (20°)	1.1

Brom, Chlor and Iodo BENZOIC ACIDS.

SOLUBILITY IN WATER AT 25°. (Paul, 1894; Löwenherz, 1898; Vaubel, 1895.)

Compound.	Formula.	Per 1000 cc Aqueous Solution. Grams.	Gram Mol.
Brombenzoic Acid	$C_6H_4Br.COOH$ (ortho)	1.856	0.00924
Brombenzoic Acid	$C_6H_4Br.COOH$ (meta)	0.402	0.00200
Brombenzoic Acid	$C_6H_4Br.COOH$ (para)	0.056	0.00028
Chlorbenzoic Acid	$C_6H_4Cl.COOH$ (ortho)	2.087	0.01333
Iodobenzoic Acid	$C_6H_4I.COOH$ (ortho)	0.952	0.00384
Iodobenzoic Acid	$C_6H_4I.COOH$ (meta)	0.116	0.00047
Iodobenzoic Acid	$C_6H_4I.COOH$ (para)	0.027	(Koopal, 1912.)

The following results at 28°. (Sieger, 1912.)

Chlorobenzoic acid	$C_6H_4ClCOOH$ (ortho)	2.25	...
"	" (meta)	0.45	...
"	" (para)	0.093	...

MUTUAL SOLUBILITY OF BROMO AND CHLOROBENZOIC ACIDS AND WATER AT HIGH TEMPERATURES, DETERMINED BY SYNTHETIC METHOD. (Flaschner and Rankin, 1910.)

p Bromobenzoic Acid + Water. t° of Melting.	Gms. Acid per 100 Gms. Mixture.	*o* Chlorobenzoic Acid + Water. t° of Melting.	Gms. Acid per 100 Gms. Mixture.	*m* Chlorobenzoic Acid + Water. t° of Melting.	Gms. Acid per 100 Gms. Mixture.	*p* Chlorobenzoic Acid + Water. t° of Melting.	Gms. Acid per 100 Gms. Mixture.
170 (Crit. sol. temp.)		100.8	5.5	123	4.2	167 (crit. t.)	
169	3	102.7	10	123.8	18.9	162	3
180	6.2	104	20	142.8 (crit. t.)	34.3	170	5.4
190	10.5	126.2 (crit. t.)	34.9	123.8	75.8	180	10
196	27	104	76	125	81.5	183	14.5
200	61	110	85.3	130	87.5	184	21.5
210	80	120	92	140	93.2	187	47
220	88.3	130	96.5	150	97.5	200	79.5
240	96.9	139.5	100	156	100	220	92
254	100					240	100

SOLUBILITY OF ORTHOCHLOROBENZOIC ACID IN AQ. SOLUTIONS OF SODIUM ACETATE, SODIUM FORMATE AND POTASSIUM FORMATE AT 25°. (Philip and Garner, 1909.)

In Aq. CH_3COONa. Grams per Liter. CH_3COONa.	$C_6H_4ClCOOH$.	In Aq. HCOONa. Grams per Liter. HCOONa.	$C_6H_4ClCOOH$.	In Aq. HCOOK. Grams per Liter. HCOOK.	$C_6H_4ClCOOH$.
1.009	3.599	0.843	3.381	0	2.128
2.484	6.181	2.102	5.258	1.025	3.396
5.027	15.60	4.196	7.637	2.563	5.226
10.07	18.27	8.410	11.02	5.124	7.543

SOLUBILITY OF CHLOROBENZOIC ACIDS IN SEVERAL SOLVENTS AT 14-16°. (Bornwater and Holleman, 1912.)

Solvent.	Gms per 100 cc. Sat. Solution. *o* $C_6H_4ClCOOH$.	*m* $C_6H_4ClCOOH$.	*p* $C_6H_4ClCOOH$.
Ligroin	0.07	0.084	trace
Carbon Tetrachloride	0.58	0.48	0.04
Benzene	0.92	0.66	0.017
Carbon Disulfide	0.52	0.62	0.016
75% Aq. Acetic Acid	6.22	...	0.32
Ethyl Ether	16.96	14	1.72
Acetone	28.42	...	2.58
Ethyl Acetate	13.20	...	1.64

Freezing-point data are given by Bornwater and Holleman (1912) for mixtures of *o*, *m* and *p* chlorobenzoic acids.

FluoroBENZOIC ACIDS C_6H_4FCOOH.

100 cc. aqueous solution saturated at 32° contain 0.882 gm. *o* $C_6H_4F.COOH$.
" " " " " " 0.308 " *m* "
" " " " " " 0.107 " *p* "

(Slothouwer, 1914.)

IodoBENZOIC ACID *p* C_6H_4ICOOH.

MUTUAL SOLUBILITY OF PARA IODOBENZOIC ACID AND WATER AT HIGH TEMPERATURES DETERMINED BY THE SYNTHETIC METHOD.

(Flaschner and Rankin, 1910.)

t° of Melting.	Gms. Acid per 100 Gms. Mixture.	t° of Melting.	Gms. Acid per 100 Gms. Mixture.	t° of Melting.	Gms. Acid per 100 Gms. Mixture
175 crit. sol. t.		207	22	230	87.4
178	3	210	41	240	92.7
190	5.8	215	63.5	269	98.1
200	10	220	77	270	100

p Iodo Bromo and ChloroBENZOIC ACID Methyl Esters.

FREEZING-POINT DATA (Solubility, see footnote, p. 1) ARE GIVEN FOR THE FOLLOWING MIXTURES.

(Jaeger, 1906)

p Chlorobenzoic methyl ester + *p* Bromobenzoic methyl ester.
" " " + *p* Iodobenzoic " "
p Iodobenzoic " " + *p* Bromobenzoic " "

HexahydroBENZOIC ACID $CH_2(CH_2.CH_2)_2.CH.COOH$.

100 gms. H_2O dissolve 0.201 gm. of the acid at 15°, *d.* saturated solution = 1.048.

(Lumsden, 1905.)

HydroxyBENZOIC ACIDS *m* and *p* (*o* = Salicylic Acid, see p. 588).

SOLUBILITY OF META AND PARA HYDROXYBENZOIC ACIDS IN WATER, BENZENE, ETC.

(Walker and Wood, 1898.)

t°.	In Water. Gms. $C_6H_4.OH.COOH$ per 100 Gms. H_2O. Meta.	Para.	In Benzene. Gms. $C_6H_4OH\,COOH$ per 100 Gms. C_6H_6. Meta.	Para.
10	0.55	0.25	...	0.0018
20	0.90	0.50	0.008	0.0027
25	1.08	0.65	0.010	0.0035
30	1.34	0.81	0.012	0.0045
35	1.64	1.01	0.015	0.0060
40	2.10	1.24	0.017	0.0082
50	3.10	2.12	0.028	0.0162
60	...	...	0.047	0.028
80	...	...	...	0.066

t°.	In Acetone. G. $C_6H_4.OH.COOH$ per 100 cc. Sol. Meta.	Para.	t°.	In Ether. G. $C_6H_4.OH.COOH$ per 100 cc. Sol. Meta.	Para.
23	26.0	22.7	17	9.73	9.43

100 gms. sat. sol. in H_2O contain 0.7 gm. *m* acid at 15° and 4 gms. at 50°.
" " " " " " 0.44 " *p* " " " " 2.98 " " "
" " " " CH_3OH " 53.58 " *m* " " "
" " " " " " 236.22 " *p* " " " (Savorro, 1914.)
" 95% formic acid dissolve 2.37 gms. *m* acid at 20.8°. (Aschan, 1913.)

MUTUAL SOLUBILITY OF META AND PARA OXYBENZOIC ACIDS AND WATER AND OF PARAMETHOXYBENZOIC ACID AND WATER AT HIGH TEMPERATURES, DETERMINED BY THE SYNTHETIC METHOD.

(Flaschner and Rankin, 1910)

Meta Oxybenzoic Acid $+H_2O$.		Para Oxybenzoic Acid $+H_2O$.		Para Methoxybenzoic Acid $+ H_2O$.	
t° of Melting.	Gms. Acid per 100 Gms. Mixture.	t° of Melting.	Gms Acid per 100 Gms. Mixture.	t° of Melting.	Gms Acid per 100 Gms. Mixture.
78.2	9.9	77	10	138.2	crit. sol. t.
90.8	20	90	19.8	140	9
98	30	97.4	29.5	142	12
103.2	39.8	104.4	40.1	144	18
108.8	49	111.8	50	145	30
119.2	60	120	59.6	146	59.4
131.4	70	134	69.2	150	73.3
143.4	77.9	154.4	80	160	89.8
175.6	90.8	180.6	90.4	170	95.6
199.8	100	213	100	184	100

Readings for t° of critical saturation obtained by cooling from t° of melting, are also given by the authors.

Coefficients of distribution of oxybenzoic acids between water and olive oil are given by Boeseken and Waterman (1911) as follows: *p* oxybenzoic acid, 0.6; *m* oxybenzoic acid, 0.4; 2.4 dioxybenzoic acid, 1.0; 2.5 dioxybenzoic acid, 0.3; 3.4 dioxybenzoic acid, 0.05; 3.4.5 trioxybenzoic acid 0.025.

Methyl**BENZOIC ACIDS** $C_6H_4COOH.CH_3$. *o, m,* and *p.*

SOLUBILITY IN WATER.

(Vaubel, 1895)

t°.	Gms $C_6H_4COOH\ CH_3$ per 1000 Gms. Sat Solution. Ortho	Meta	Para.
25	1.18	0.98	0.35

Nitro**BENZOIC ACIDS** $C_6H_4.NO_2.COOH$. *o, m,* and *p.*

SOLUBILITY IN SEVERAL SOLVENTS.

(de Connick, 1894; for solubility in H_2O, see also Paul; Vaubel; Löwenherz; Goldschmidt, 1898; Holleman, 1898; Noyes and Sammet, 1903, Sidgwick, 1910)

Solvent.	t°.	Gms $C_6H_4\ NO_2\ COOH$ per 100 cc Solvent. Ortho	Meta.	Para
Water	15	0.625	0.238	0.0213
"	20	0.682 (0 645G.)	0.315	0 039
"	25	0 738 (0.779G.)	0.341	0.028 (0.045)
"	30	0.922 (0 922G.)	...	...
"	35	1.141 (1.054)	0.477	0.0419
Methyl Alcohol	10	42.72	47.34	9.6
Ethyl Alcohol	10	28.2	33.1 (11.7°)	0.9
" " (abs.)	15	37.58*	47.26*	19.71*
" " (33 Vol.%)	15	0.64 (11.8°)	0.52	0.055
Acetone	10	41.5	41.5	4.54
Benzene	10	0.294	0.795	0.017 (12.5°)
Carbon Disulfide	10	0.012	0.10 (8.5°)	0.007
Chloroform	10	0.455 (11°)	5.678	0.066
"	15	1.06†	3.45†	0 088†
"	25	1.13†	4.7†	0.114†
"	35	1.59†	6.31†	0.156†
Ether	10	21.58	25.175	2.26
Ligroin	10	trace	0.013	0

* = Gms. acid per 100 cc. saturated solution. † = Gms. acid per 100 gms. solvent.

SOLUBILITY OF ORTHO NITROBENZOIC ACID IN WATER. (Noyes and Sammet, 1903.)

t°.	$C_6H_4NO_2COOH$ *o* per Liter Sol. Millimols.	Grams.	t°.	$C_6H_4NO_2COOH$ *o* per Liter Sol. Millimols.	Grams.
10	26.62	4.645	25	43.3	7.231
15	31.06	5.187	30	51.6	8.616
20	36.57	6.106			

Additional determinations by other investigators, in millimols $C_6H_4NO_2COOH$ *o* per liter at 25°, are: 46.5 (van Maarseveen, 1898); 44.19 (Paul, 1894); 42.3 (Holleman, 1898); 43.6 (Kendall, 1911).

SOLUBILITY OF ORTHO, META AND PARA NITROBENZOIC ACIDS IN WATER AT HIGH TEMPERATURES, DETERMINED BY THE SYNTHETIC METHOD. (Flaschner and Rankin, 1910.)

o $C_6H_4NO_2COOH+H_2O$. t° of Melting.	Gms. Acid per 100 Gms. Sat. Sol.	*m* $C_6H_4NO_2COOH+H_2O$. t° of: Melting.	Solution.	Gms. Acid per 100 Gms. Sat. Sol.	*p* $C_6H_4NO_2COOH+H_2O$. t° of Melting.	Gms Acid per 100 Gms. Sat. Sol.
52 crit. t.	...	63.2	...	2	118 crit. t.	...
69	5	77.4	...	6	143	5
75	9.9	77.4	90	7	150	9
78	13.5	77.4	100	10.5	155	14.5
79	49.5	77.4	105	17	160	30
80	62	77.4	107.5 crit. t.	30	165	53.5
85	73.5	77.4	106	50	170	65.5
90	78.6	77.4	100	58.6	180	76.7
100	83.5	77.4	90	65.4	190	83.2
120	94	80	...	74	200	88
148	100	100	...	88.5	220	95.2
		120	...	96.8	237	100
		140.4	...	100		

Data for the solubility of mixtures of *o*, *m* and *p* nitrobenzoic acids in water at 24.4° are given by Holleman (1898).

SOLUBILITY OF ORTHO NITROBENZOIC ACID IN AQUEOUS SOLUTIONS OF HYDROCHLORIC, FORMIC, MALONIC AND SALICYLIC ACIDS AT 25°. (Kendall, 1911.)

Solvent.	Normality of Solvent.	Gms. *o* $C_6H_4NO_2COOH$ per Liter Sat. Solution.	Solvent.	Normality of Solvent.	Gms. *o* $C_6H_4NO_2.COOH$ per Liter Sat. Solution.
HCl	0.0179	6.146	$CH_2(COOH)_2$	0	7.281
"	0.0357	5.661	"	0.0313	7.144
"	0.125	4.976	"	0.1001	6.934
"	0.250	4.997	"	0.2004	6.656
"	0.500	4.752	$C_6H_4(OH)COOH$	0.0094	7.276
HCOOH	0.0517	7.188	"	0.0136	7.352
"	0.0998	7.124	"	0.0162	7.369

SOLUBILITY OF ORTHO NITROBENZOIC ACID IN AQUEOUS SOLUTIONS OF DEXTROSE, SODIUM CHLORIDE, AND OF SODIUM NITRATE.

Original results in molecular quantities. (Hoffman and Langbeck, 1905).

In Dextrose: G. $C_6H_{12}O_6$ per 100 cc. Solution.	G.(*o*)$C_6H_4NO_2.COOH$ per 100 g. Solvent. At 25°.	At 35°.	In NaCl: G. NaCl. per 100 cc. Solution.	G.(*o*)$C_6H_4NO_2.COOH$ per 100 g. Solvent. At 25°.	At 35°.	In $NaNO_3$: G.$NaNO_3$ per 100 cc. Solution.	G.(*o*)$C_6H_4NO_2.COOH$ per 100 g. Solvent. At 25°.	At 35°.
0.0	0.736	1.063	0.117	0.743	1.072	0.170	0.746	1.074
0.36	0.736	1.064	0.195	0.746	1.075	0.284	0.754	1.080
1.80	0.732	1.061	0.585	0.749	1.070	0.851	0.767	1.096
9.50	0.722	1.051	2.425	0.688	0.967	4.255	0.774	1.097
20.00	0.703	1.030	5.80	0.597	0.831	8.510	0.748	1.047

SOLUBILITY OF ORTHO NITROBENZOIC ACID IN AQUEOUS SOLUTIONS OF SODIUM BUTYRATE, ACETATE, FORMATE, AND SALICYLATE AT 26.4°.

(Philip, 1905.)

Original results in terms of $\frac{\text{Mols.}}{100}$ per liter.

Gms. Na Salt per Liter.	Gms. Ortho $C_6H_4COOH.NO_2$ per Liter of Solution in: C_3H_7COONa.	CH_3COONa.	$HCOONa$.	C_6H_4 OH.COONa.
0	7.85	7.85	7.85	7.85
0.5	8.35	8.50	8.60	8 35
1.0	8.90	9.15	9.50	8.70
2	10.0	10.80	11.5	9.4
3	11.2	12.55	13.5	11.0
4	12 4	14.5	15.6	11.5
6	15.2	...	...	...

SOLUBILITY OF ORTHO NITROBENZOIC ACID IN SEVERAL ALCOHOLS.

(Timofeiew, 1894)

Solvent.	t°.	Gms. Acid per 100 Gms. Sat. Sol.	Solvent.	Solvent.	t°.	Gms Acid per 100 Gms Sat. Sol.	Solvent.
CH_3OH	0	36.2	56.6	C_3H_7OH	0	17.7	21.5
"	22	52.2	109.1	"	22	31.2	45.5
C_2H_5OH	0	23.3	30.4	$(CH_3)_2CH.CH_2OH$	0	9.65	10.7
"	22	42.7	74.5				

Freezing-point data for mixtures of *o* nitrobenzoic acid and dimethylpyrone are given by Kendall (1914a).

SOLUBILITY OF META NITROBENZOIC ACID IN SEVERAL ALCOHOLS.

(Timofeiew, 1894.)

Solvent.	t°.	Gms. Acid per 100 Gms. Sat. Sol.	Solvent	Solvent.	t°.	Gms Acid per 100 Gms Sat. Sol.	Solvent.
CH_3OH	0	41.9	72.2	C_2H_5OH	21.5	43.9	89.8
"	19	53.7	116	C_3H_7OH	0	24.1	31.8
"	21.5	57.1	133.1	"	19	31	45
C_2H_5OH	0	33.6	50.6	"	21.5	32.5	48
"	19	42.3	73.2				

SOLUBILITY OF META NITROBENZOIC ACID IN AQUEOUS SOLUTIONS OF SODIUM ACETATE, SODIUM FORMATE, SODIUM MONOCHLORACETATE AND POTASSIUM FORMATE AT 25°.

(Philip and Garner, 1909)

In CH_3COONa. Gms per Liter. CH_3-COONa.	*m* $C_6H_4NO_2$-COOH.	In HCOONa. Gms. per Liter. HCOONa.	*m* $C_6H_4NO_2$-COOH.	In $CH_2ClCOONa$. Gms per Liter. CH_2Cl-COONa.	*m* $C_6H_4NO_2$-COOH.	In HCOOK. Gms. per Liter. HCOOK.	*m* $C_6H_4NO_2$-COOH.
0	3.424	0	3.424	0	3.424	0	3.424
1.009	5.144	0.843	4.776	1.375	4.075	1.025	4.742
2.484	7.932	2.102	6.380	3.426	4.876	2.563	6.446
5.027	12.61	4.196	8.616	6.839	5.861	5 124	8.551
10.07	20.77	8.410	11.90	13.710	7.264		

SOLUBILITY OF PARA NITRO BENZOIC ACID IN AQUEOUS SOLUTIONS OF ANILIN AND OF PARA TOLUIDIN AT 25°.

(Löwenherz — Z. physik. Chem. 25, 395, '98.)

In Anilin.				In p-Toluidin.			
G. Mols. per Liter.		Gms. per Liter.		G. Mols. per Liter.		Gms. per Liter.	
$C_6H_5NH_2$.	$C_6H_4NO_2.COOH$.	$C_6H_5NH_2$.	$C_6H_4NO_2.COOH$.	$C_6H_4NH_2.CH_3$.	$C_6H_4NO_2.COOH$.	$C_6H_4NH_2.CH_3$.	$C_6H_4NO_2.COOH$.
0.0	0.00164	0.0	0.274	0.0	0.00164	0.0	0.274
0.01	0.00841	0.91	1.406	0.01	0.0100	1.071	1.671
0.02	0.01379	1.82	2.304	0.02	0.0174	2.142	2.902
0.04	0.02172	3.64	3.629	0.03	0.0245	3.213	4.097
0.08	0.0347	7.29	5.798				

1000 cc. of sat. solution of para nitrobenzoic acid in aqueous 1 normal sodium para nitrobenzoate contain 0.0046 gm. mols. = 0.768 gm. $pC_6H_4NO_2COOH$ at 25°. (Sidgwick, 1910.)

SOLUBILITY OF PARA NITROBENZOIC ACID IN SEVERAL ALCOHOLS.

(Timofeiew, 1894)

Solvent.	t°.	Gms. Acid per 100 Gms. Sat. Sol.	Gms. Acid per 100 Gms. Solvent.	Solvent.	t°.	Gms. Acid per 100 Gms. Sat. Sol.	Gms. Acid per 100 Gms. Solvent.
CH_3OH	18.5	3.45	3.57	C_2H_5OH	21	3.22	3.32
"	21	3.75	3.90	C_3H_7OH	18.5	2.12	2.17
C_2H_5OH	18.5	3.25	3.36	"	19.5	1.85	1.90
"	19.5	3.16	3.26	"	21	2.29	2.34

DinitroBENZOIC ACIDS $C_6H_3(NO_2)_2COOH$. 1.3.5 and 1.2.4.

SOLUBILITY OF 3.5 AND OF 2.4 DINITROBENZOIC ACIDS IN AQUEOUS SOLUTIONS OF SODIUM ACETATE AT 25°.

(Philip and Garner, 1909.)

Gms. per 100 cc. Sat. Sol.		Gms. per 100 cc. Sat. Sol.	
CH_3COONa.	$3.5C_6H_3(NO_2)_2COOH$.	CH_3COONa.	$2.4C_6H_3(NO_2)_2COOH$.
0	0.1314	0	0.0572
0.0976	0.3392	0.0976	0.2056
0.2428	0.6720	0.2428	0.3434
0.4846	1.201	0.4846	0.5023
0.9718	2.115	0.9718	0.7440

Data for the solubility of 1.3.5 dinitrobenzoic acid in water and aqueous solutions of KCl, NaCl, KNO_3 and $NaNO_3$, and for its distribution between water and benzene at 25°, are given by B. de Szyszkowski (1915).

SOLUBILITY OF 1.3.5 DINITROBENZOIC ACID IN WATER AT HIGH TEMPERATURES, DETERMINED BY THE SYNTHETIC METHOD.

(Flaschner and Rankin, 1910.)

t°.	Gms. Acid per 100 Gms. Sol.	t°.	Gms. Acid per 100 Gms. Sol.	t°.	Gms. Acid per 100 Gms. Sol.
123.8 crit. t.	...	123	66.5	160	90.9
113	4.4	125	72.7	180	95
120	9.3	130	79.3	200	99
121	14.5	140	85.7	206	100
122	40	150	89		

SOLUBILITY OF NITROBROMOBENZOIC ACIDS AND OF NITROCHLOROBENZOIC ACIDS IN WATER AT 25°.

(Holleman, 1910)

Acid.	Gms. Acid per 100 cc. Sol.	Acid.	Gms. Acid per 100 cc. Sol.
$C_6H_3COOH.NO_2.Br$ 1.2.3	0.033	$C_6H_3COOH.NO_2Cl$ 1.2.3	0.047
$C_6H_3COOH.NO_2.Br$ 1.2.5	0.741	$C_6H_3COOH.NO_2.Cl$ 1.2.5	0.967

Holleman also gives data for the solubility of various mixtures of the above two bromo compounds and of the two chloro compounds and uses the results for estimating the quantity of each in an unknown mixture.

Dinitro *p* oxyBENZOIC ACID $C_6H_2OH(NO_2)_2COOH$.

SOLUBILITY OF MIXTURES OF DINITRO PARA OXYBENZOIC ACID AND OTHER COMPOUNDS IN ABSOLUTE ETHYL ALCOHOL AT 29.6°.

(Morgenstern, 1911)

Dinitro *p* Oxybenzoic Acid + Phenanthrene. Gms. per 100 gms Sat. Sol.			Dinitro *p* Oxybenzoic Acid + Fluorene. Gms. per 100 Gms. Sat. Sol			Dinitro *p* Oxybenzoic Acid + Retene. Gms. per 100 Gms. Sat. Sol.		
Acid.	Phenanthrene.	Solid Phase.	Acid.	Fluorene	Solid Phase.	Acid.	Retene.	Solid Phase.
2 0483	0.1333	Acid	2 0440	0 1232	Acid	2 0232	0	Acid
2.0776	0 2796	"	2.0823	0 3484	"	2 0434	0 1236	"
2.1249	0 5267	"	2.1045	0 4824	"	2 0933	0 3446	"
2.2195	1 0311	"	2.1744	0 8960	"	2 1276	0 5162	"
2.2883	1 4310	"	2.2618	1.4308	"	2 2346	1 0489	"
1 2171	6 0092	Phenanthrene	1 0490	3 8618	Fluorene	2 3034	1 3634	"
0 8681	5 8300	"	0 8004	3 7566	"	1 9664	3 3698	Retene
0.6017	5 6890	"	0 5620	3 6532	"	0 7830	3 0032	"
0 3487	5 5619	"	0 3900	3 5811	"	0 5597	2 9331	"
0 2157	5 4890	"	0 2113	3 5024	"	0 2740	2 8466	"
0	5 3781	"	0	3 4115	"	0	2 2795	"

BENZOIC ANHYDRIDE $(C_6H_5CO)_2O$.

Freezing-point data are given for mixtures of benzoic anhydride and sulfuric acid by Kendall and Carpenter (1914).

BENZOIN (Benzoyl phenyl carbinol) $C_6H_5CH(OH)COC_6H_5$.

SOLUBILITY OF BENZOIN IN WATER, PYRIDINE AND AQUEOUS 50% PYRIDINE AT 20-25°.

(Dehn, 1917.)

Solvent.	Gms. Benzoin per 100 gms Solvent.
Water	0 03
Aq. 50 % Pyridine	6.63
Pyridine	20.20

100 gms. 95% formic acid dissolve 3.06 gms. benzoin at 18.5°. (Aschan, 1913.)

Freezing-point data (solubilities, see footnote, p. 1) are given by Vanstone (1913), for mixture of benzoin and each of the following compounds:

Dibenzyl, benzylaniline, benzylideneaniline and hydrazobenzene.

BENZOPHENONE $(C_6H_5)_2CO$.

SOLUBILITY IN AQUEOUS ALCOHOL AND IN OTHER SOLVENTS.

(Derrien — Compt. rend. 130, 722, '00; Bell — J. Physic. Chem. 9, 550, '05.)

In Aqueous Alcohol at 40°.

(Bell.)

Wt. % Alcohol in Solvent.	Gms. $(C_6H_5)_2CO$ per 100 Gms. Solvent.	Gms. $(C_6H_5)_2CO$ per 100 Gms. Solution.	Wt. % Alcohol in Solvent.	Gms. $(C_6H_5)_2CO$ per 100 Gms. Solvent.	Gms. $(C_6H_5)_2CO$ per 100 Gms. Solution.
40	2	1.9	67.5	39	28.1
45	5	4.8	70	56	35.9
50	8	8.3	71	67	39.2
55	11	9.9	72	90	47.4
60	16	13.8	72.5	105	51.2
65	28	22.6	73	156	61.0

In Aqueous Alcohol and other Solvents.

(Derrien.)

Solvent.	t°.	Gms. $(C_6H_5)_2CO$ per 100 cc. Solvent.	Solvent.	t°.	Gms. $(C_6H_5)_2CO$ per 100 cc. Solvent.
97% Ethyl Alcohol	17	13.5	Ethyl Ether (rectified)	12.7	17.5
85 cc. 97% Alcohol + 15 cc. H_2O	17	3.8	Benzene	17	76.9
80 " " + 20 "	17	2.2	Xylene	17.6	38.4
75 " " + 26 "	17	1.3	Nitro Benzene	15.8	58.8
Methyl Alcohol (pure)	9.8	11	Chloroform (com.)	16.5	55.5
" " "	15	14.3	Bromoform	17.3	33.3
Acetic Ether (pure)	9.6	19.2	Toluene	17.2	55.5
Carbon Disulfide	16.1	66.6	Ligroine	14.6	6.7

Determinations made by means of the Pulfrich refractometer (Osaka, 1903-8), gave 39 gms. benzophenone per 100 gms. absolute ethyl alcohol at 20°, and 78.6 gms. benzophenone per 100 gms. benzene at 25°.

SOLUBILITY OF BENZOPHENONE IN AQUEOUS SOLUTIONS OF PHENOL AND OF *n* BUTYRIC ACID, DETERMINED BY THE SYNTHETIC METHOD, ARE GIVEN BY TIMMERMANS (1907).

In Aq. 36.51% C_6H_5OH (Sat. t = 65.3). t° of Sat.	Gms. $(C_6H_5)_2CO$ per 100 Gms. Sat. Sol.	In Aq. 71.4% C_6H_5OH (Sat. t = 20.6). t° of Sat.	Gms. $(C_6H_5)_2CO$ per 100 Gms. Sat. Sol.	In Aq. 39.4% C_3H_7COOH (Sat. t = −2.3). t°. of Sat.	Gms. $(C_6H_5)_2CO$ per 100 Gms. Sat. Sol.
75.4	0.685	26.1	0.96	6.1	0.439
81.1	1.06	29.3	1.77	18.5	1.12
85.3	1.41	39.5	4.06	28.9	1.71
88.1	1.67	55.5	7.82	44	2.66
		82.6	16.82	61.6	3.92
				75.2	5.09

Solubility data for mixtures of benzophenone and resorcinol and for benzophenone and pyrocatechinol, determined by the freezing-point method, are given by Freundlich and Posnjak (1912). Similar data for mixtures of benzophenone and thymol are given by Pawlewski (1893). Results for mixtures of benzophenone and sulfuric acid are given by Kendall and Carpenter (1914).

BENZOYL CHLORIDE, BENZOYL tetra hydro quinaldine, *d* and *l*.

Fusion-point data are given for mixtures of benzoyl chloride and phenol by Tsakalotos and Guye (1910), and for mixtures of the *d* and *l* forms of benzoyl tetrahydroquinaldine, by Adriani (1900).

BENZYLAMINE HYDROCHLORIDE $C_6H_5CH_2.NH_2.HCl$.

100 gms. H_2O dissolve 50.6 gms. of the compound at 25°. (Peddle and Turner, 1913.)

DiBENZYLAMINE HYDROCHLORIDE $(C_6H_5CH_2)_2NH.HCl$.

100 gms. H_2O dissolve 2.17 gms. of the compound at 25°. (Peddle and Turner, 1913.)
100 gms. chloroform dissolve 0.37 gm. of the compound at 25°. " "

TriBENZYLAMINE HYDROCHLORIDE $(C_6H_5CH_2)_3N.HCl$.

100 gms. H_2O dissolve 0.61 gm. of the compound at 25°. (Peddle and Turner, 1913)
100 gms. chloroform dissolve 11.41 gms. of the compound at 25°. " "

DiBENZYL $C_6H_5CH_2.C_6H_5CH_2$, **BENZYLANILINE** $C_6H_5CH_2.NHC_6H_5$.

SOLUBILITY DATA, DETERMINED BY THE FREEZING-POINT METHOD (see footnote, p. 1), ARE GIVEN FOR THE FOLLOWING MIXTURES:

Dibenzyl + Stilbene	(Bruni, 1898; Pascal and Normand, 1903.)
" + Benzylphenol	(Pascal and Normand, 1913.)
" + Hydrobenzene	" "
" + Tolane	" "
Benzylaniline + Dibenzyl	" "
" + Stilbene	" "
" + Benzylphenol	" "
" + Hydrazobenzene	" "
" + Tolane	" "

NitroBENZYL CHLORIDE *p* $C_6H_5CHNO_2.Cl$.

SOLUBILITY IN SEVERAL SOLVENTS AT 25°. (v. Halban, 1913.)

Solvent.	Gms *p* $C_6H_5CHNO_2Cl$ per 100 Gms Solvent.	Gms *p* $C_6H_5CHNO_2Cl$ per 100 Gms Sat. Sol.	Solvent.	Gms *p* $C_6H_5CHNO_2Cl$ per 100 Gms. Solvent.	Gms *p* $C_6H_5CHNO_2Cl$ per 100 Gms. Sat. Sol.
Methyl Alcohol	8.87	8.15	Nitrobenzene	57.8	36.4
Ethyl Alcohol	7.10	6.63	Ethylacetate	57.8	36.4
Propyl Alcohol	5.70	5.39	Ethylbenzoate	43.3	30.2
Amyl Alcohol	4.88	4.65	Ethylnitrite	51.2	33.9
Butyl Alcohol	21.5	17.7	Isoamylbromide	12.5	10.4
Acetic Acid	18.1	15.3	Brombenzene	32	24.2
Acetone	107	51.7	Chloroform	47.6	32.3
Acetophenone	63.1	38.7	Carbon Tetrachloride	6.05	5.69
Paraldehyde	24.9	19.9	Benzylchloride	45.3	31.2
Ether	23.1	18.8	α Bromnaphthaline	31.7	23.4
Acetonitrile	96.6	49.1	*n* Hexane	1.30	1.28
Nitromethane	68.8	40.8	Isopentane	0.49	0.49
o Nitrotoluene	51.1	33.8	Benzene	69.7	37.4

Data for the lowering of freezing-point are given by Holleman (1914) for mixtures of *o* and *p* nitro benzylchloride.

DiBENZYL HYDRAZINE $C_6H_5CH_2.NH.C_6H_5CH_2NH$.

Reciprocal solubilities of dibenzylhydrazine and cinnamylidene, determined by the method of lowering of the fr.-pt. (see footnote, p. 1), are given by Pascal ('14).

ChloronitroBENZYLIDENES $C_6H_5C:NO_2.Cl$. **BENZYLIDENE NAPHTHALAMINES** $C_6H_5CH:NC_{10}H_7$.

DATA FOR THE LOWERING OF THE FREEZING-POINTS (solubilities, see footnote, p. 1) ARE GIVEN FOR THE FOLLOWING MIXTURES.

o Chloronitrobenzylidene + *m* Chloronitrobenzylidene	(Holleman, 1914.)
p " + *m* "	"
p " + *o* "	"
α Benzylidene naphthalamine + β Benzylidene naphthalamine	(Pascal and Normand, '13.)

BERYLLIUM ACETATE (basic) $Be_4O(CH_3COO)_6$.

100 gms. chloroform dissolve 33.3 gms. $Be_4O(CH_3COO)_6$ at 18°. (Wirth, 1914.)

BERYLLIUM Potassium FLUORIDE, etc.

SOLUBILITY IN WATER AND IN ACETIC ACID SOLUTIONS.
(Marignac; Sestini, 1890.)

Salt.	Formula.	Solvent.	Gms. Anhydrous Salt per 100 Gms. Solvent. At 20°.	At 100°.
Beryllium potassium fluoride	$BeF_2.KF$	Water	2.0	5.2
" sodium "	$BeF_2.NaF$	"	1.4	2.8
" hydroxide	$Be(OH)_2$	Water + CO_2 sat.	0.0185 (BeO)	...
" phosphate	$Be_3(PO_4)_2.6H_2O$	2% CH_3COOH	0.055	...
" "	"	10% "	0.1725	...

BERYLLIUM HYDROXIDE $Be(OH)_2$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE.
(Rubenbauer — Z. anorg. Chem. 30 334, '02.)

Moist $Be(OH)_2$ used, solutions shaken 5 hours, temperature probably about 20°.

Per 20 cc. Solution. Gms. Na.	Gms. Be.	Molecular Dilution of the NaOH.	Gms. per 100 cc. Solution. NaOH.	$Be(OH)_2$.
0.3358	0.0358	1.37	2.917	0.850
0.6716	0.0882	0.68	5.840	2.094
0.8725	0.1175	0.53	7.585	2.789
1.7346	0.2847	0 27	18.310	6.760

SOLUBILITY IN AQUEOUS SODIUM HYDROXIDE AT DIFFERENT TEMPERATURES.
(Haber and Oordt, 1904.)

Normality of Aq. NaOH.	Gm. BeO per Liter Sat. Sol. at: 20–23°.	50–53°.	100°.
0.5	0.060	0.080	0.080
1	0.170	0.230	0.290
2	0.570	0.900	1.020

BERYLLIUM OXALATE $BeC_2O_4.3H_2O$.

100 gms.	water	dissolve	63.2 gms.	$BeC_2O_4.3H_2O$ at 25°	(Wirth, 1914.)
"	0.1 *n* oxalic acid	"	75.92 "	" "	"
"	0.1 *n* sulfuric "	"	72.65 "	" "	"
"	1.0 *n* " "	"	52.8 "	" "	"

BERYLLIUM PALMITATE and Salts of Other Fatty Acids.

SOLUBILITIES IN ETHYL AND METHYL ALCOHOLS AT 25°. (Jacobson and Holmes, 1916.)

Solvent.	Gms. of Each Salt (Determined Separately) per 100 Gms. Solvent. Be Palmitate.	Be Stearate.	Be Laurate.	Be Myristate.
Ethyl Alcohol	0.004	...	0.004	0.004
Methyl Alcohol	0.042	0.040	0.050	0.047

BERYLLIUM SULFATE $BeSO_4.6H_2O$.

SOLUBILITY IN WATER. (Levi, Malvano, 1906.)

t°.	Mols. H_2O per 1 Mol. $BeSO_4$.	Gms. $BeSO_4$ per 100 Gms. Water.	Solution.	Solid Phase.	t°.	Mols. H_2O per 1 Mol. $BeSO_4$.	Gms. $BeSO_4$ per 100 Gms. Water.	Solution.	Solid Phase.
31	11.18	52.23	34.32	$BeSO_4.6H_2O$	95.4	6.44	90.63	47.55	$BeSO_4.4H_2O$
50	9.62	60.67	37.77	"	107.2	5.06	115.3	53.58	"
72.2	7.79	74.94	42.85	"	111	4.55	128.3	56.19	"
77.4	7.13	81.87	45.01	"	80	6.89	84.76	45.87	$BeSO_4.2H_2O$
30	13.33	43.78	30.45	$BeSO_4.4H_2O$	91.4	5.97	97.77	49.42	"
40	12.49	46.74	31.85	"	105	4.93	118.4	54.21	"
68	9.42	61.95	38.27	"	119	3.91	149.3	59.88	"
85	7.65	76.30	43.28	"					

SOLUBILITY OF BERYLLIUM SULFATE IN AQUEOUS SULFURIC ACID AT 25°.

(Wirth, 1912-13)

Gms. H_2SO_4 per 100 Gms. Solvent.	Gms. $BeSO_4$ per 100 Gms. Sat. Sol.	Solid Phase.	Gms. H_2SO_4 per 100 Gms. Solvent.	Gms. $BeSO_4$ per 100 Gms. Sat Sol	Solid Phase.
0	8.212	$BeSO_4.6H_2O$	45.51	6.628	$BeSO_4.6H_2O$
5.23	8.429	"	50.63	5.438	$BeSO_4.4H_2O$
9.61	7.944	"	56.59	3.640	"
18.70	6.603	"	63.24	2.244	"
34	5.631	"	65.24	2.128	"
40.35	5.773	"	73.64	2.185	"

Freezing-point data for mixtures of beryllium sulfate and potassium sulfate are given by Grahmann (1913).

BERYLLIUM Meta**VANADATE** $Be(VO_3)_2.4H_2O$.

100 gms. H_2O dissolve 0.1 gm. of the salt at 25°. (Brinton, 1916)

BETAINE (Trimethyl glycocoll) $C_5H_{11}O_2N.H_2O$.

SOLUBILITY OF ANHYDROUS BETAINE IN WATER AND ALCOHOLS.

(Stoltzenberg, 1914)

(Figures read from the author's curves.)

t°.	Gms. $C_5H_{11}O_2N$ per 100 Gms. H_2O.	CH_3OH.	C_2H_5OH	t°.	Gms $C_5H_{11}O_2N$ per 100 Gms H_2O.	CH_3OH	C_2H_5OH.
−10	134	38	5	50	197	70	16
0	140	43	6	60	215	75	18.5
+10	147	49	7	70	236	80	22
20	157	54	8.5	80	259	..	25
30	168	60	11	90	286	..	...
40	182	65	13	100	328	..	...

BETAINE SALTS.

SOLUBILITY OF EACH, SEPARATELY, IN WATER.

(Stoltzenberg, 1914)

Grams per 100 Grams H_2O

t°.	$C_5H_{11}O_2N.$ HCl	$C_5H_{11}O_2N.$ HBr	$C_5H_{11}O_2N.$ HI.	$C_5H_{11}O_2N$ H_2SO_4 H_2O.	$C_5H_{11}O_2N.$ H_3PO_4.	$C_5H_{11}O_2N.$ $HMnO_4$	$C_5H_{11}O_2N.$ $HAuCl_4$.
−10	38	28	35	67	35	1.5	1.3
0	44	39	66	86	45	1.75	1.5
+10	52	52	98	107	58	2.5	2
20	60	65	130	132	73	5	3
30	70	79	162	164	91	9	4.5
40	81	94	198	203	112	16	6
50	93	110	231	250	135	30	8
60	106	127	269	306	160	(55°) 48	11.5
70	120	144	304	...	190	...	15
80	135	162	(75°) 321	...	223	...	18
90	151	183	...	...	...	...	23
100	169	206	...	...	...	...	...

Data are also given by Stoltzenberg for the following basic salts of betaine $(C_5H_{11}O_2N)_2HCl.H_2O$, $(C_5H_{11}O_2N)_2.HBr$, $(C_5H_{11}O_2N)_2HI$, $(C_5H_{11}O_2N)_2H_2SO_4$ and $(C_5H_{11}O_2N)_2HAuCl_4.H_2O$.

BETOL (β-Naphthylsalicylate) $\beta C_7H_5O_3.C_{10}H_7$.

Freezing-point data including super solubility curves, are given for mixtures of betol and salol by Miers and Isaac, 1907.

BISMUTH Bi.

RECIPROCAL SOLUBILITIES, DETERMINED BY THE METHOD OF LOWERING OF FUSION-POINT (see footnote, p. 1), ARE GIVEN FOR THE FOLLOWING MIXTURES:

Bismuth + Bromine	(Eggink, 1908.)
" + Chlorine	"
" + Iodine	(Amadori and Becarelli, 1912.)
" + Sulfur	(Aten, 1905; Palabon, 1904.)

MUTUAL SOLUBILITY OF BISMUTH AND ZINC. (Spring and Romanoff, 1906.)

t°.	Upper Layer %Bi.	Upper Layer %Zn.	Lower Layer %Bi.	Lower Layer %Zn.	t°.	Upper Layer %Bi.	Upper Layer %Zn.	Lower Layer %Bi.	Lower Layer %Zn.
266	86	14	..	..	584	80	20	10	90
419	..	..	3	97	650	77	23	15	85
475	84	16	5	95	750	70	30	27	73
					810–820 (crit. temp.)				

BISMUTH CHLORIDE. $BiCl_3$. BSMUTH OxyCHLORIDE $BiOCl.H_2O$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID.

Results at 25°. (Noyes and Hall, 1917) Results at 30°. (Jacobs, 1917.)

d_{4}^{25} of Sat. Sol.	Gms. Atoms per 1000 Gms. H_2O: Cl.	Bi.	H(=Cl−3Bi).	Gms. per 100 Gms. Sat. Solution: Bi_2O_3.	HCl.	Solid Phase.
1.002	0.3477	0.00130	0.3438	0.60	2.40	$BiOCl.H_2O$
1.007	0.4350	0.00376	0.4237	5.35	5.69	"
1.010	0.5221	0.00869	0.4960	8.17	8.47	"
1.013	0.6244	0.01767	0.5714	8.70	8.93	"
1.018	0.7375	0.03138	0.6434	14.52	13.02	"
1.025	0.8824	0.05338	0.7223	18.60	15.80	"
1.036	1.0760	0.08937	0.8079	30.10	21.7	"
1.044	1.2277	0.1177	0.8746	36.95	25.4	"
1.061	1.5321	0.1810	0.9891	54.70	31.5	"
1.083	1.9021	0.2657	1.105	56	32.8	BiOCl
1.157	3.1865	0.5685	1.481	58.5	33	$BiCl_3.2H_2O$
1.237	4.5056	0.9022	1.799	56.6	33.8	" $+BiCl_3$
1.288	5.325	1.100	2.025	56.25	34.9	$BiCl_3$
1.329	6.066	1.317	2.115	55.9	35.9	$BiCl_3.HCl$

SOLUBILITY OF BISMUTH CHLORIDE IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. $BiCl_3$ per 100 cc. Solvent.	Gms. $BiCl_3$ per 100 Gms Solvent.	Authority.
Acetone	18°	...	17.9 (d_{18}=0.9194)	(Naumann, 1904, '05.)
Ethyl Acetate	18°	...	1.66 (d_{18}=0.9106)	(Naumann, 1910).
Anhydrous Hydrazine	ord. temp.	32	...	(Welsh and Broderson, 1915.)

100 gms. 95% formic acid dissolve 0.05 gm. bismuth oxychloride (BiOCl) at 19.8°. (Aschan, 1913.)

Freezing-point data are given for $BiCl_3+CuCl$, $BiCl_3+FeCl_3$, $BiCl_3+PbCl_2$, $BiCl_3+PbBr_2$ and $BiCl_3+ZnCl_2$ by Herrmann (1911) and for $BiCl_3+TlCl$ by Scarpa (1912).

BISMUTH CITRATE $(CH_2)_2C(OH)(COO)_3Bi$. BISMUTH Ammonium CITRATE.

SOLUBILITY OF EACH IN WATER AND IN AQUEOUS ETHYL ALCOHOL AT 25°. (Seidell, '10.)

Gms. C_2H_5OH per 100 Gms Solvent.	Gms $C_6H_5O_7Bi$ per 100 Gms Sat. Sol.	Gms C_2H_5OH per 100 Gms. Solvent.	Gms. $Bi.NH_4$ Citrate per 100 Gms. Sat. Sol.	d_{25} Sat. Sol.
0	0.011	0	22.25	1.25
51	0.041	51	1.34	0.92
91.4	0.065	91.4	None	0.81

BISMUTH HYDROXIDE $Bi(OH)_3$.

SOLUBILITY OF BISMUTH HYDROXIDE IN AQUEOUS SOLUTIONS OF SODIUM AND POTASSIUM HYDROXIDES AT 20° AND AT 100°.

(Moser, 1909.)

Gms. KOH per Liter.	Gms Dissolved $Bi(OH)_3$ per Liter at: 20°.	100°.	Gms. NaOH per Liter.	Gms. Dissolved $Bi(OH)_3$ per Liter at: 20°.	100°.
28	0	0.188	20	0	0.188
50	trace	0.249	40	trace (0.0014)*	0.249
112	0.037	0.373	80	0.050 (0.0029)*	0.436
168	0.074	...	120	0.087 (0.0054)*	0.622
224	0.100	0.622	160	0.100	...
280	0.124	0.622	200	0.124	0.622
336	0.137	...	240	0.137	...
448	0.137	1.494	320	0.137	1.494
560	0.174	2.054	400	0.199	2.120

* Results at 25° by Knox (1909)

At 100° some $Bi(OH)_3$ was converted into $BiO(OH)$.

SOLUBILITY OF BISMUTH HYDROXIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AND OF POTASSIUM BROMIDE AT 30°.

(Herz and Bulla, 1909.)

(An excess of bismuth hydroxide, prepared according to Moses and having the composition corresponding to BiO.OH, was shaken 2–3 weeks at 30° with aqueous KCl and KBr. The analyses of the sat. solutions are expressed in terms of millimols KOH and KCl or KBr. They have been calculated for the following table to gms. BiO.OH and KCl or KBr.)

Solvent.	Gms. per 100 cc Sat Sol. BiO OH.	KCl.	Solvent.	Gms. per 100 cc Sat Sol. BiO OH.	KBr
2 *n* KCl	3.759	13.75	1 *n* KBr	8.555	7.67
3 *n* KCl	5.745	20.71	2 *n* KBr	17.785	15.02

BISMUTH IODIDE BiI_3.

100 gms. absolute alcohol dissolve 3.5 gms. BiI_3 at 20°. (Gott and Muir, 1888.)
100 gms. methylene iodide, CH_2I_2, dissolve 0.15 gm. BiI_3 at 12°. (Retgers, 1893.)

BISMUTH NITRATE $Bi(NO_3)_3.5H_2O$.

100 gms. acetone dissolve 48.66 gms. $Bi(NO_3)_3.5H_2O$ at 0°, and 41.7 gms. at 19°. (von Laszczynski, 1894.)

SOLUBILITY OF BISMUTH NITRATE IN AQUEOUS NITRIC ACID AND IN AQUEOUS NITRIC ACID CONTAINING ACETONE, AT ORDINARY TEMPERATURE.

(Dubrissay, 1911.)

Solvent.	Gms $Bi(NO_3)_3$ per per 100 cc sat Sol.	Solid Phase.
0.922 *n* HNO_3	86.86	$Bi(NO_3)_3.5H_2O$
0.922 " " + 6.66% Acetone	85.51	"
0.922 " " +13.33% "	81.96	"
2.3 " "	80.37	"
2.3 " " +16.66% "	74.47	"

SOLUBILITY OF DOUBLE NITRATES OF BISMUTH AND MAGNESIUM, NICKEL, COBALT, ZINC AND MANGANESE IN CONC. HNO_3 AT 16°.

(Jantsch, 1912.)

(d_{16} of HNO_3 = 1.325, 100 cc. of this acid contained 51.59 gms. HNO_3.)

Double Salt.	Gms. Hydrated Salt per 100 cc. Sat. Solution.	Double Salt.	Gms. Hydrated Salt per 100 cc. Sat. Solution.
$Bi_2Mg_3(NO_3)_{12}.24H_2O$	41.69	$Bi_2Zn_3(NO_3)_{12}.24H_2O$	57.51
$Bi_2Ni_3(NO_3)_{12}.24H_2O$	46.20	$Bi_2Mn_3(NO_3)_{12}.24H_2O$	65.77
$Bi_2Co_3(NO_3)_{12}.24H_2O$	54.67		

BISMUTH OXIDE Bi_2O_3.

SOLUBILITY OF BISMUTH OXIDE IN AQUEOUS NITRIC ACID AT 20°.
(Rutten and van Bemmelen, 1902)

Present in Shaker Flask. Per 1 part $Bi_2O_3.3N_2O_5.10H_2O$.	Gms. per 100 Gms. Solution. Bi_2O_3	Gms. per 100 Gms. Solution. N_2O_5	Mols. per 100 Mols. H_2O. Bi_2O_3	Mols. per 100 Mols. H_2O. N_2O_5	Ratio $Bi_2O_3 : N_2O_5$.	Solid Phase.
24.4 parts H_2O	0.321	0.963	0.126	1.61	1:12.8	$Bi_2O_3.N_2O_5.2H_2O$
3.2 parts H_2O	6.37	7.17	2.844	13.82	1: 4.8	"
Dilute HNO_3	18.74	15.9	10.50	38.65	1: 3.6	$Bi_2O_3.N_2O_5.H_2O$
Dilute HNO_3	31.48	23.7	27.2	83.8	1: 3.0	"
Dilute HNO_3 = 6.13% N_2O_5	32.93	24.83	30.15	97.97	1: 3.2	$Bi_2O_3.N_2O_5.H_2O$ and $Bi_2O_3.3N_2O_5.10H_2O$
6.816% N_2O_5	32.67	24.70	29.70	96.57	1: 3.2	$Bi_2O_3.3N_2O_5.10H_2O$
24.0% N_2O_5	24.16	28.25	19.65	98.76	1: 5.0	"
51.0% N_2O_5	11.66	46.62	10.81	186.23	1:17.2	"
70.0% N_2O_5	20.76	53.75	33.51	355.87	1:10.6	"
	27.85	51.02	51.0	403.0	1: 7.9	$Bi_2O_3.3N_2O_5.10H_2O$ and $Bi_2O_3.3N_2O_5.3H_2O$
Anhydrous HNO_3	8.56	68.28	14.35	492.0	1:34.3	$Bi_2O_3.3N_2O_5.3H_2O$
Bi_2O_3+ "	4.05	74.90	7.45	592.9	1:79.5	"

Results are also given for 9°, 30°, and 65°.

BISMUTH TriPHENYL $Bi(C_6H_5)_3$.

Fusion-point data (see footnote, p. 1) are given for mixtures of bismuth triphenyl and mercury diphenyl by Cambi (1912).

BISMUTH SALICYLATE (basic, 64% Bi_2O_3).

SOLUBILITY IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°.
(Seidell, 1910)

Gms. C_2H_5OH per 100 Gms. Solvent.	Gms. Salt per 100 Gms. Sat. Sol.	Gms. C_2H_5OH per 100 Gms. Solvent.	Gms. Salt per 100 Gms. Sat. Sol.
0	0.010	80	0.065
20	0.015	90	0.095
40	0.022	92.3	0.105
60	0.036	100	0.160

BISMUTH SELENIDE Bi_2Se_3.

Fusion-point data (see footnote, p. 1) are given for mixtures of bismuth selenide and silver selenide by Pelabon (1908).

BISMUTH SULFIDE Bi_2S_3.

1 liter H_2O dissolves 0.00018 gm. Bi_2S_3 at 18°.
(Weigel, 1906; see also Bruner and Zawadski, 1912.)

SOLUBILITY OF BISMUTH SULFIDE IN AQUEOUS ALKALI SULFIDE SOLUTIONS AT 25°.
(Knox, 1909)

Solvent.	Gms. Bi_2S_3 per 100 cc. Sat. Solution.	Solvent.	Gms. Bi_2S_3 per 100 cc. Sat. Solution.
0.5 *n* Na_2S	0.0040	0.5 *n* Na_2S + 1 *n* NaOH	0.0185
1.0 *n* "	0.0238	1 *n* Na_2S + 1 *n* NaOH	0.0838
1.5 *n* "	0.1023	0.5 *n* K_2S + 1 *n* KOH	0.0240
0.5 *n* K_2S	0.0043	1 *n* K_2S + 1 *n* KOH	0.1230
1 *n* "	0.0337	1.25 *n* K_2S + 1.25 *n* KOH	0.2354
1.5 *n* "	0.0639		

Freezing-point data (see footnote, p. 1) are given for mixtures of bismuth sulfide and bismuth telluride by Amadori (1915).

BORAX, see sodium tetraborate, p. 629.

BORIC ACID H_3BO_3.

SOLUBILITY OF BORIC ACID IN WATER.

(Nasini and Ageno, 1909)

t°.	Gms. H_3BO_3 per 100 Gms. Sat. Sol.	t°.	Gms. H_3BO_3 per 100 Gms. Sat Sol.	t°.	Gms. H_3BO_3 per 100 Gms. Sat Sol.
−0.76 Eutec	2.27	30	6.30	80	19.11
0	2.59	40	8.02	90	23.30
+10	3.45	50	10.35	100	28.7
20	4.8	60	12.90	110	38.7
25	5.5	70	15.70	120	52.4

The results of Herz and Knoch (1904), and one determination by Auerbach (1903), given in terms of gms. per 100 cc. sat. solution, appear to be in good agreement with the above. The earlier data of Ditte (1877) are low.

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF HYDROCHLORIC, SULPHURIC, AND NITRIC ACIDS AT 26°.

(Herz — Z. anorg. Chem. 33, 355, 34, 205, '03.)

Normality of the H_2SO_4, HCl or HNO_3.	Normality of Dissolved $B(OH)_3$.	Gms. Strong Acid per 100 cc. Solution.	Gms. $B(OH)_3$ per 100 cc. Solution. In HCl.	In H_2SO_4.	In HNO_3.
0	0.91	0	5.64	5.64	5.64
0.5	0.78	5	4.0	4.25	4.50
1.0	0.71	10	3.2	3.6	3.9
2.0	0.58	15	2.45	3.0	3.35
3.0	0.49	20	1.8	2.5	2.9
4.0	0.41	25	...	2.0	2.55
5.0	0.35	30	...	1.55	2.1
6.0	0.26	35	..	...	1.75

The determinations given in the original tables in terms of normal solutions when plotted together lay close to an average curve drawn through them. The figures in the tables here shown were read (and calculated) from the average curve.

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF ELECTROLYTES AT 25°.

(Bogdan — Ann. Scient. Univ. Jassy, 2, 47, '02–'03)

Gms. Electrolyte per 100 Gms. H_2O.	Grams H_3BO_3 per 100 Gms. H_2O in Aq. Solutions of: NaCl.	KCl.	$NaNO_3$.	KNO_3.	Na_2SO_4.	K_2SO_4.
0	5.75	5.75	5.75	5.75	5.75	5.75
10	5.75	5.80	5.78	5.81	5.88	5.92
20	5.74	5.86	5.81	5.88	6.00	6.10
40	5.72	5.98	5.87	6.04	6.33	6.50
60	5.72	6.12	5.95	6.20	6.70	6.92
80	5.71	6.29	6.02	6.37	7.10	7.40

Interpolated from the original.

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AND OF ALKALI CHLORIDES AT 25°. (Herz, 1910.)

(The original results are given in millimols per 10 cc. They have been calculated to gram quantities, plotted on cross-section paper and the following values read from the curves.)

Gms. HCl or Alkali Chloride per 100 cc. Sat. Sol.	Gms. H_3BO_3 Dissolved per 100 cc. Sat Sol. in Aq.: HCl.	LiCl.	NaCl.	RbCl.	KCl.
0	5.59	5.59	5.59	5.59	5.59
2	4.92	5.20	5.40	5.60	5.67
4	4.36	4.85	5.30	5.62	5.75
6	3.88	4.45	5.20	5.67	5.85
8	3.50	4.07	5.15	5.72	5.90
10	3.15	3.75	5.10	5.77	6
15	...	3	5.07	5.90	6.25
20	...	...	...	6.10	6.50
30	...	...	...	6.55	...

THE SYSTEM BORIC ACID, ACETIC ACID AND WATER AT 30°. (Dukelski, 1909.)

(The sat. solutions and residues were analyzed by titrating total acidity with 0.1 *n* NaOH and the acetic acid alone by an iodometric method.)

Gms. per 100 Gms. Sat. Sol. B_2O_3.	$(CH_3CO)_2O$.	Solid Phase.	Gms. per 100 Gms Sat. Sol. B_2O_3.	$(CH_3CO)_2O$.	Solid Phase.	Gms per 100 Gms. Sat Sol B_2O_3	$(CH_3CO)_2O$.	Solid Phase.
3.55	...	$B(OH)_3$	1.01	73.96	$B(OH)_3$	4.98	82.13	$B_2O_3.2(CH_3CO)_2O$
3.18	7.78	"	0.54	80.67	"	5.13	84.60	"
2.98	16.44	"	0.45	84.55	"+(?)	5.41	85.68	"
2.34	28.96	"	0.39	84.65	"	4.82	88.74	$B_2O_3.3(CH_3CO)_2O$
1.98	41.06	"	0.41	84.48	"	4.71	89.98	"
1.47	52.63	"	0.46	84.44	"	4.06	92.68	"
1.12	67.76	"	0.50	84.51	"	3.10	95.76	"

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF:

Acetic Acid at 26°. (Herz, 1903a.)

Normality of Solutions. CH_3COOH.	$B(OH)_3$.	Gms. per 100 cc. Solution. CH_3COOH.	$B(OH)_3$.
0	0.91	0	5.64
1	0.82	5	4.7
2	0.65	10	4.2
4	0.42	20	3.0
6	0.25	30	2.0

Acetone at 20°. (Herz and Knoch, 1904.)

cc. Acetone per 100 cc. Solvent.	$B(OH)_3$ per 100 cc. Solution. Millimols.	Grams.
0	79.15	4.91
20	81.71	5.07
30	83.35	5.17
40	82.72	5.13
50	81.62	5.06
60	76.40	4.74
70	67.62	4.19
80	55.05	3.41
100	8.06	0.50

SOLUBILITY OF BORIC ACID IN AQUEOUS SOLUTIONS OF UREA, ACETONE, AND OF PROPYL ALCOHOL AT 25° (Bogdan.)

Grams of $CO(NH_2)_2$, $(CH_3)_2CO$ or of C_3H_7OH per 100 Gms. H_2O.	Gms. H_3BO_3 per 100 g. H_2O in Aq. Solutions of: $CO(NH_2)_2$	$(CH_3)_2CO$.	C_3H_7OH.
0	5.75	5.75	5.75
10	5.84	5.84	5.80
20	5.93	5.93	5.85
40	6.13	6.12	5.94
60	6.31	6.29	6.03

Solubility of Boric Acid in Aqueous Solutions of Several Alcohols at 25°.

(Mueller and Abegg, 1906.)

In Aq. Methyl Alcohol. Solvent. d_{25}.	Wt. % CH_3OH.	Gms. H_3BO_3 per 100 cc. Sat. Sol.	In Aq. Ethyl Alcohol. Solvent. d_{25}.	Wt. % C_2H_5OH.	Gms. H_3BO_3 per 100 cc. Sat. Sol.	In Aq. Propyl Alcohol. Solvent. d_{25}.	Wt % C_3H_7OH.	d_{25} of Sat. Sol.	Gms. H_3BO_3 per 100 cc. Sat. Sol.
0.9691	19	5.55	0.9714	20.2	5.14	0.9043	50.83	0.9193	3.99
0.9340	41.5	6.27	0.9350	42.3	4.96	0.8231	79.41	0.8570	2.83
0.9185	50	6.81	0.8789	67.3	4.52	0.8133	95.5	0.8466	3.58
0.9019	58	7.20	0.8576	76.2	4.34	0.8010	100	0.8297	5.96
0.8842	66	8.10	0.8198	91.1	5.54				
0.7960	100	17.99*	0.8089	95	6.85				
			0.7947	100	9.47†				

* d_{25} = 0.8904. † d_{25} = 0.8553.

In Aq. *i* Butyl Alcohol. Solvent. d_{25}.	Mol. % C_4H_9OH.	d_{25} of Sat. Sol.	Gms. H_3BO_3 per 100 cc. Sat. Sol.	In Aq. *i* Amyl Alcohol. Solvent. d_{25}.	Mol. % $C_5H_{11}OH$.	d_{25} of Sat. Sol.	Gms. H_3BO_3 per 100 cc. Sat. Sol.
0.9923	0.70	1.0124	5.48	0.9943	0.448	1.0132	5.48
0.9853	2.15	1.0038	5.32	0.9936	0.520	1.0125	5.46
0.9855	2.18	1.0046	5.32	0.9931	0.525*	1.0123	5.46
0.8173	71.4	0.8351	2	0.8232	67.26†	0.8290	1.60
0.8133	77.1	0.8220	2.15	0.8183	75.54	0.8253	1.69
0.8081	85.6	0.8195	2.61	0.8142	83.40	0.8223	1.98
0.7984	100	0.8172	4.30	0.8068	100	0.8220	3.54

* = H_2O sat. with amyl alcohol. † = Amyl alcohol sat. with H_2O.

One liter H_2O saturated with amyl alcohol dissolves 55.5 gms. H_3BO_3 at 15°. (Auerbach, 1903)

Solubility of Boric Acid in Aqueous Solutions of Ethyl Alcohol at 15° and at 25°.

(Seidell, 1908)

Results at 15°. d_{15} of Sat. Sol.	Gms. C_2H_5OH per 100 Gms. Solvent.	Gms. H_3BO_3 per 100 Gms. Sat. Sol.	Results at 25°. d_{25} of Sat. Sol.	Gms. C_2H_5OH per 100 Gms Solvent.	Gms. per 100 Gms Sat Sol. H_3BO_3.	Gms. per 100 Gms Sat Sol. C_2H_5OH.
1.014	0	4.11	1.018	0	5.42	0
0.9986	8.9	3.90	0.987	20	5.20	18.96
0.9658	32	3.58	0.952	40	5.10	37.96
0.9268	51	3.48	0.908	60	5	57
0.8820	70.2	3.22	0.862	80	5.05	75.96
0.8389	91.3	5.06	0.853	85	5.30	80.50
0.8370	93.6	5.70	0.842	90	6.20	84.4
0.8356	99.8	9.18	0.838	95	8	87.4
			0.838	100	11.20	88.8

Solubility of Boric Acid in Aqueous Solutions of Lactic Acid, Oxalic Acid, *d* and *i* Tartaric Acids at 25°.

In Aq. Lactic Acid. (Mueller and Abegg, 1906)

Solvent. d_{25}.	Mol. % $C_3H_6O_3$.	d_{25} of Sat. Sol.	Gms. H_3BO_3 per 100 cc. Sat. Sol.
1.0252	2.321	1.0444	6.64
1.0722	6.819	1.0986	9.98
1.1405	18.77	1.1635	11.53
1.2023	36.33	1.2254	12.90

In Aq. Oxalic Acid. (Herz, 1910)

Gms per 100 cc. Sat. Sol. $H_2C_2O_4$.	H_3BO_3.	Solid Phase.
2.26	6.17	H_3BO_3
5.36	6.70	"
12.39	7.44	" $+H_2C_2O_4$
11.27	3.45	$H_2C_2O_4$
10.84	0.97	"
10.77	0.55	"
10.63	0	"

In Aq. *d* and *i* Tartaric Acid. (Herz, 1911.)

Gms. per 100 cc. Sat. Sol. $C_4H_6O_6$.		H_3BO_3.
0		5.59
11.25	*d* Acid	6.20
22.5	"	6.63
45	"	7.48
9.45	*i* Acid	6.11
18.90	"	6.48
37	"	7.23

Solubility of Boric Acid in:

Pure Glycerol (Sp.Gr. = 1.260 at 15.5°).
(Hooper — Pharm. J. Trans. [3] 13, 258, '82.)

t°.	Gms. $B_2O_3 \cdot 3H_2O$ per 100 cc. Glycerine	Gms. $B(OH)_3$ per 100 Gms Glycerine.	Gms. $B(OH)_3$ per 100 Gms Solution.
0	20	15.87	13.17
10	24	19.04	16.00
20	28	22.22	18.21
30	33	26.19	20.75
40	38	30.16	23.17
50	44	34.92	25.95
60	50	39.68	28.41
70	56	44.65	30.72
80	61	48.41	32.61
90	67	53.18	34.70
100	72	57.14	36.36

Aq. Solutions of Glycerol at 25°.
(Herz and Knoch — Z. anorg. Chem. 45, 268, '05.)

Wt % Glycerine in Solvent.	Millimols $B(OH)_3$ per 100 cc. Sol.	Sp. Gr. at $\frac{25°}{4°}$.	Gms. $B(OH)_3$ per 100 cc. Solution.	Gms. $B(OH)_3$ per 100 Gms. Solution.
0	90.1	1.017	5.59	5.50
7.15	90.1	1.038	5.59	5.38
20.44	90.6	1.063	5.62	5.28
31.55	92.9	1.090	5.76	5.29
40.95	97.0	1.113	6.02	5.41
48.7	103.0	1.133	6.39	5.64
69.2	140.2	1.187	8.69	7.32
100.0	390.3	1.272	24.20	19.02

In Aqueous Solutions of Glycerol at 25°.
(Mueller and Abegg, 1906.)

Solvent $d_{\frac{25}{4}}$.	Solvent Mol % $C_3H_8O_3$.	Solvent Wt % $C_3H_8O_3$.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. H_3BO_3 per 100 cc. Sat. Sol.
1.1574	24.64	60	1.1707	7.49
...	46.75	...	1.2260	13.22
1.2370	67.71	90	1.2526	18.35
1.2531	90.58	96.6	1.2710	23.44

Aqueous Solutions of Dulcite at 25°.
(Mueller and Abegg, 1906.)

Solvent $d_{\frac{25}{4}}$.	Solvent Mol % $C_6H_8(OH)_6$.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. H_3BO_3 per 100 cc. Sat. Sol.
0.9995	0.065	1.0686	5.50
1.0018	0.130	1.0212	5.63
1.0060	0.260	1.0260	5.81

100 gms. glycerol (d_{15} = 1.256) dissolve 11 gms. H_3BO_3 at 15°–16°. (Ossendowski, 1907.)

100 gms. dichlorethylene dissolve 0.006 gm. H_3BO_3 at 15°. (Wester and Brunis, 1914.)
100 gms. trichlorethylene dissolve 0.016 gm. H_3BO_3 at 15°. " "
100 cc. anhydrous hydrazine dissolve 55 gms. H_3BO_3 at room temp. (Welsh and Broderson, 1915.)

Solubility of Boric Acid in Aqueous Solutions of Mannite at 25° and Vice Versa.

(Ageno and Valla, 1912, 1913.)

Grams per 100 cc. Sat. Sol. H_3BO_3.	Grams per 100 cc. Sat. Sol. $C_6H_{14}O_6$.	Solid Phase.	Gms per 100 cc Sat. Sol. H_3BO_3.	Gms per 100 cc Sat. Sol. $C_6H_{14}O_6$.	Solid Phase.
5.50	0	H_3BO_3	8.70	25.65	H_3BO_3
5.90	1.82	"	9.43	32.43	" $+C_6H_{14}O_6$
6.29	5.46	"	7.71	27.97	$C_6H_{14}O_6$
6.44	7.28	"	5.75	25.65	"
6.64	9.11	"	4.92	24.65	"
6.83	10.93	"	3.46	23.03	"
7.08	12.75	"	2.87	22.98	"
7.27	14.57	"	1.64	20.80	"
7.71	18.99	"	0	19.58	"

Additional determinations at 30° also given.

Determinations at 25°, differing somewhat from the above, are given by Mueller and Abegg (1906).

Data for the system boric acid, phenol and water are given by Timmermans (1907).

Distribution of Boric Acid between Water and Amyl Alcohol at 25°.

(Fox — Z. anorg. Chem. 35, 130, '03.)

Millimols $B(OH)_3$ in		Gms. $B(OH)_3$ in 100 cc.		Millimols $B(OH)_3$ in		Gms. $B(OH)_3$ in 100 cc	
Aq. Layer.	Alcoholic Layer.	Aq. Layer.	Alcoholic Layer.	Aq. Layer.	Alcoholic Layer.	Aq. Layer.	Alcoholic Layer.
265.8	76.6	1.648	0.475	87.9	33.2	0.545	0.206
196.5	59.5	1.219	0.369	75.2	22.7	0.466	0.141
159.6	47.5	0.990	0.294	64.6	19.76	0.400	0.123
126.0	37.1	0.781	0.230				

Results at 15°. (Mueller and Abegg, 1906)

Millimols $B(OH)_3$ per Liter.		Gms $B(OH)_3$ per 100 cc.		Millimols $B(OH)_3$ per Liter		Gms $B(OH)_3$ per 100 cc	
Aq. Layer.	Alcohol Layer.	Aq. Layer.	Alcohol Layer	Aq. Layer.	Alcohol Layer.	Aq. Layer.	Alcohol Layer.
894	264	5.44	1.64	427.4	127.6	2.65	0.79
607.2	176.4	3.76	1.09	372	110	2.31	0.68
589.3	177.4	3.65	1.10	289.1	84.9	1.79	0.53

Data agreeing with those of Fox at 25° are also given by Mueller and Abegg, 1906. One determination at 35° gave 0.907 gm. $B(OH)_3$ per 100 cc. aq. layer and 0.274 gm. per 100 cc. alcohol layer.

Distribution of Boric Acid between Aqueous Sodium Chloride Solutions and Amyl Alcohol at 25°.

(Mueller and Abegg, 1906)

Gms. per 100 cc.: Aq Layer		Alcohol Layer		$d_{\frac{25}{4}}$ of Alcohol Layer	Gms. per 100 cc.: Aq Layer		Alcohol Layer		$d_{\frac{25}{4}}$ of Alcohol Layer.
NaCl.	H_3BO_3	H_2O	H_3BO_3		NaCl.	H_3BO_3	H_2O	H_3BO_3	
0	5.46	7.39	1.65	0.8296	16.64	5.13	4.71	1.79	0.8247
5.53	5.37	6.40	1.65	0.8277	17.90	5.02	4.31	1.79	0.8241
8.72	5.27	5.90	1.67	0.8268	20.36	5.02	4.19	1.87	0.8240
10.91	5.23	5.46	1.69	0.8259	23.52	4.97	3.59	1.96	0.8233
13.84	5.16	5.15	1.77	0.8254	25.03	4.95	3.20	1.99	0.8229

Distribution of Boric Acid between Water and Mixtures of Amyl Alcohol and Carbon Disulfide at 25°.

(Herz and Kurzer, 1910)

75 Vol. % $C_5H_{11}OH$ + 25 Vol. % CS_2. Gms H_3BO_3 per 100 cc		50 Vol. % $C_5H_{11}OH$ + 50 Vol. % CS_2. Gms H_3BO_3 per 100 cc		25 Vol. % $C_5H_{11}OH$ + 95 Vol. % CS_2. Gms H_3BO_3 per 100 cc	
Aqueous Layer	$C_5H_{11}OH+CS_2$. Layer	Aqueous Layer	$C_5H_{11}OH+CS_2$ Layer.	Aqueous Layer.	$C_5H_{11}OH+CS_2$. Layer
0.387	0.095	0.469	0.095	0.433	0.053
0.743	0.171	0.839	0.161	0.910	0.108
1.143	0.266	1.207	0.226	1.343	0.164
1.590	0.365	1.791	0.344	1.940	0.238

BORIC ANHYDRIDE B_2O_3.

Fusion-point data (solubilities, see footnote, p. 1) are given for mixtures of B_2O_3+CaO and B_2O_3+SrO by Guertler (1904).

BORIC ACID (Tetra) $H_2B_4O_7$.

100 grams water dissolve 2.69 grams $H_2B_4O_7$ at 15°, Sp. Gr. = 1.015. (Gerlach, 1889.)

BORON TRI-FLUORIDE BF_3.

1 cc. H_2O absorbs 1.057 cc. BF_3 at 0° and 762 mm.; 1 cc. conc. H_2SO_4 (Sp. Gr. 1.85) absorbs 50 cc. BF_3.

BRASSIDIC ACID $C_8H_{17}CH:CHC_{11}H_{22}COOH$.

Solubility data determined by the freezing-point method are given by Mascarelli and Sanna (1915), for mixtures of brassidic and erucic acids and brassidic and isoerucic acids.

BROMAL HYDRATE $CBr_3.CH(OH)_2$

The distribution coefficient of bromal hydrate between olive oil and water is 0.665 at ord. temp. (Baum, 1899); 0.7 at ord. temp. (Meyer, 1909).

BROMINE Br.

SOLUBILITY IN WATER.

(Winkler — Chem Ztg. 23, 687, '99; Roozeboom — Rec. trav. chim 3, 29, 59, 73, 84, '84; Dancer — J. Chem. Soc. 15, 477, '62; at 15°, Dietze — Pharm. Ztg. 43, 290, '08.)

t°.	Grams Bromine per 100 Grams. Water. (W.)	Water. (R. D. & D.)	Solution (W.)	Solution (R. D. & D.)	"Absorption Coefficient."* α.	"Solubility."* q.
0	4.17	4.22	3.98	4.05	60.5	43.1
5	3.92	3 7	3 77	3.57	45 8	32.4
10	3.74	3.4	3.61	3 29	35.1	24.8
15	3.65	3.25	3.52	3.15	27.0	19.0
20	3.58	3.20	3.46	3.10	21.3	14.8
25	3.48	3.17	3 36	3.07	17 0	11.7
30	3.44	3.13	3.32	3.03	13.8	9.4
40	3.45	...	3.33	...	9.4	6.2
50	3.52	...	3.40	...	6.5	4.0
60	...	...	...	...	4.9	2.8
80	...	...	...	...	3.0	1.1

* For definition of "Absorption Coefficient" α and "Solubility" q, see Acetylene, p. 16.

One liter sat. solution of bromine in water contains 0.21 mol. Br_2 = 33.56 gms. Br at 25°. (Bray and Connolly, 1910.)

The coefficient of solubility of bromine in water at 15°, determined by an aspiration method, is given as 33 by Jones (1911). This investigator also gives the figure 56 for the solubility coefficient in 25 vol. % acetic acid and 551 for 90 vol. % acetic acid at 15°.

Data for the distribution of bromine between water and air at 25°, are given by Hantzsch and Vagt (1901).

SOLUBILITY OF BROMINE IN AQUEOUS SOLUTIONS OF MERCURIC BROMIDE AT 25° AND VICE VERSA.

(Herz and Paul, 1914.)

Gms per 100 cc. Sat. Sol. $HgBr_2$.	Br.	Solid Phase.	Gms. per 100 cc. Sat Sol. $HgBr_2$.	Br.	Solid Phase.
0	3.40	Br_2	0.763	3.57	Br_2+HgBr_2
0.202	3.53	"	0.701	2.88	$HgBr_2$
0.285	3.55	"	0.664	1.20	"
0.462	3.56	"			

SOLUBILITY OF BROMINE IN AQUEOUS SOLUTIONS OF POTASSIUM BROMIDE.

(Results at 0° and 25°, Boericke, 1905; at 0°, Jones and Hartmann, 1916; at 18.5° and 26.5°, Worley, 1905.)

Gm. Mols KBr per Liter.	Gms. KBr per Liter.	Gms. Bromine Dissolved per Liter of Sat. Solution at: 0°.	18.5°.	25°.	26.5°.
0	0	41.6 (24.2)	35.56	34	34.23
0.005	0.59	41.7 (25.5)	36.1	34.3	35.1
0.010	1.19	42.6 (26.2)	37	35	36
0.020	2.38	44.4 (27.5)	38.56	36.5	37.35
0.050	5.95	50.2 (31.5)	43.8	41	42.5
0.100	11.90	59.7 (40)	52.23	49.3	51.87
0.20	23.80	79.1 (57.1)	69.69	67.3	68.69
0.50	59.51	138.6 (111.9)	123	119	116
0.80	92.22	200 (174)	178.70	176	168.10
1	119.02	243.1 (217.5)	216	216.5	204
1.725	205.2	402.3 (395.9)	...	...	...
1.82	216.6	423.8 (423)	...	...	...
2.17	258.2	511.7 (511.7)	...	...	...
3.033	360.8	736.7 ...	...	632.4	...

Very accurate determinations at 0°, at concentrations of KBr below 0.01 normal, are given by Jones and Hartmann. Liquid bromine in contact with aqueous solutions at 0° is slowly converted to the hydrate, $Br_2.10H_2O$, with a reduction in amount of dissolved bromine. At this temperature there are, consequently, two saturation concentrations. The unstable one being for solutions in contact with liquid bromine and the stable one being for solutions in contact with $Br_2.10H_2O$. The results for the latter are shown in parentheses in the above table.

SOLUBILITY OF BROMINE IN AQUEOUS SOLUTIONS OF POTASSIUM SULPHATE, SODIUM SULPHATE, AND OF SODIUM NITRATE AT 25°.

(Jakowkin — Z. physik. Chem. 20, 38, '96.)

Normality of Salt Solution.	In K_2SO_4 Gms. per Liter. K_2SO_4.	Br.	In Na_2SO_4 Gms per Liter. Na_2SO_4.	Br.	In $NaNO_3$ Gms. per Liter. $NaNO_3$.	Br.
1	91.18	25.14	63.55	25.07	85.09	28.80
½	45.59	29.44	31.77	29.20	42.54	31.35
¼	22.79	31.46	15.88	31.33	21.27	32.62
⅛	11.39	32.70	7.94	32.94	10.63	33.33
1/16	5.69	33.10	3.97	33.26	5.31	33.74

SOLUBILITY OF BROMINE IN AQUEOUS SALT SOLUTIONS AT 25°.

(McLauchlan, 1903.)

Salt.	Gms. Salt per Liter.	Normality of Dissolved Br.	Gms Br per Liter.	Salt.	Gms. Salt per Liter.	Normality of Dissolved Br.	Gms. Br. per Liter.
Water	0.0	0.424	33.95	NH_4NO_3	80.11	0.688	55.15
Na_2SO_4	63.55	0.286	23.9	NaCl	58.50	0.701	55.90
K_2SO_4	91.18	0.310	24.8	KCl	74.60	0.718	57.40
$(NH_4)_2SO_4$	70.04	0.971	77.7	NH_4Cl	53.52	1.028	82.2
$NaNO_3$	85.09	0.3495	28.0	CH_3COONH_4	77.09	4.26	340.5
KNO_3	101.19	0.362	28.95	H_2SO_4*	49.03	0.366	29.26

* Wildeman.

SOLUBILITY OF BROMINE IN AQUEOUS SOLUTIONS OF SODIUM BROMIDE AT 25°.

(Bell and Buckley, 1912.)

Grams per Liter Sat. Sol. NaBr	Br.	d_{25} of Sat. Sol.	Gms per Liter Sat. Sol. NaBr.	Br.	d_{25} of Sat. Sol.
92.6	99.2	1.213	319.7	546	1.997
160.5	176.7	1.372	359	641.6	2.137
205.8	247.8	1.515	...	769.2	2.327
255.8	343	1.678	408.3	834	2.420

RECIPROCAL SOLUBILITY OF BROMINE AND CHLORINE, BROMINE AND HYDROBROMIC ACID AND BROMINE AND SULFUR DIOXIDE, DETERMINED BY METHOD OF LOWERING OF THE FREEZING-POINT (see footnote, p. 1).

Results for Bromine + Chlorine. (Lebeau, 1906; see also Karsten, 1907.)		Bromine + Hydrobromic Acid. (Büchner and Karsten, 1908–09)			Bromine + Sulfur Dioxide. (van der Goot, 1913)	
t° of Melting.	Gms Br per 100 Gms. Mixture.	t° of Melting.	Gms. Br per 100 Gms. Mixture	Mol % Br in Mixture.	t° of Melting	Gms Br per 100 Gms. Mixture.
−102.5	0	−87.3	0	0	−75.1	0
−100	6.5	−90	6	2.5	−75.3*	1.73
−90	31	−95*	11.2	4.8	−60	4
−80	48.6	−90	11.8	5	−40	12.5
−70	60.4	−80	15.2	6.8	−30	21
−60	70	−70	22	11.5	−20	35.5
−50	79	−60	31.7	19	−18	40.5
−40	86.3	−50	43	30	−16	48
−30	91.1	−40	54.5	43.5	−14	72
−20	95.2	−30	66.2	60	−13	90
−10	89	−20	79.5	76.5	−10	96.5
−7.3	100	−12.5	90	90	−7.1	100

* Eutec..

SOLUBILITY DATA, DETERMINED BY THE FREEZING-POINT METHOD (see footnote, p. 1), ARE GIVEN FOR THE FOLLOWING MIXTURES:

Bromine + Methyl alcohol (Maass and McIntosh, 1912)
" + Ethyl alcohol " "
" + Ethyl acetate " "
" + Ethyl bromide (Wroczynski and Guye, 1910.)
" + Iodine (Meerum-Terwogt, 1905; Kruyt and Heldermann, 1916.)
" + Sulfur (Ruff and Winterfeld, 1903)

100 grams saturated solution of bromine in carbon disulfide contain 45.4 grams Br at −95°, 39 grams at −110.5°, and 36.9 grams at −116°.

(Arctowski, 1895 — 1896.)

DISTRIBUTION OF BROMINE BETWEEN WATER AND CARBON TETRACHLORIDE AT 0°.

(Jones and Hartmann, 1916.)

Gm. Br_2 per Gm. CCl_4 Solution.	Density CCl_4–Br_2.	Gms Bromine per Liter H_2O Layer.	CCl_4 Layer.	Gm. Br_2 per Gm CCl_4. Solution	Density CCl_4–Br_2.	Gms Bromine per Liter. H_2O Layer.	CCl_4 Layer.
0.01640	1.6454	1.28	26.99	0.07261	1.6896	5.35	122.82
0.01847	1.6470	1.44	30.45	0.08162	1.6972	6.03	138.66
0.05433	1.6755	4.12	91.12	0.08661	1.7012	6.30	184.41
0.06126	1.6809	4.59	103.07	0.1646	1.7667	11.22	291.10

DISTRIBUTION OF BROMINE AT 25° BETWEEN WATER AND:

(Calculated from results of Jakowkin, 1895. Those in parentheses from Herz and Kurzer, 1910)

Carbon Disulfide. Gms. Br. per Liter of: Aq. Layer.	CS_2 Layer.	Bromoform. Gms. Br per Liter of: Aq. Layer.	$CHBr_3$ Layer.	Carbon Tetrachloride. Gms. Br. per Liter of: Aq. Layer.	CCl_4 Layer.
0.5	36 (35)	0.5	33	0.5	15 (13)
1	80 (75)	1	66	1	28 (23)
2	163 (155)	2	136	2	60 (45)
3	240 (230)	3	206	3	90 (70)
4	330 (310)	4	276	4	123 (95)
5	420 (395)	5	346	5	156 (122)
6	515 (480)	6	415	6	190 (150)
7	620 (565)	...	...	8	260 (220)
				10	340 (300)
				12	430 (400)
				14	520 (550?)

Lewis and Storch (1917) point out that Jakowkin (1896) failed to take into consideration, the hydrolysis of the bromine in the aqueous phase in the very dilute solutions. They used 0.001 *n* HCl which prevents the hydrolysis but is presumably too dilute to affect the true solubility. The distribution coefficient found in this way, given in terms of mols. Br per 1000 gms. H_2O, divided by the mol. fraction of Br in the CCl_4, is 0.3705 at 25°. These authors also give a series of determinations of the distribution of bromine between 0.1 *n* HBr and CCl_4 at 25°.

DISTRIBUTION OF BROMINE BETWEEN WATER AND MIXTURES OF CARBON DISULFIDE AND CARBON TETRACHLORIDE AT 25°.

(Herz and Kurzer, 1910)

25 Vol. % CS_2 + 75 Vol. % CCl_4. Gms Bromine per Liter Aq Layer.	CS_2+CCl_4 Layer.	50 Vol. % CS_2+50 Vol. % CCl_4. Gms Bromine per Liter Aq. Layer.	CS_2+CCl_4 Layer.	75 Vol. % CS_2+25 Vol. % CCl_4. Gms Bromine per Liter Aq. Layer.	CS_2+CCl_4 Layer.
0.79	28.4	0.63	28.7	0.71	46
1.53	58.4	1.19	54.5	1.34	87.2
2.32	86.6	1.76	81.1	3.98	213.8
2.98	111.3	2.45	110.9	5.06	330.5
3.66	137.8	2.95	132.9	6.82	444.2
5.26	205.1	6.47	343.8		
7.95	324.9	7.97	447.7		
9.66	432.2				

DISTRIBUTION OF BROMINE AT 25° (Herz and Rathmann, 1913) BETWEEN:

Water and Tetrachlorethane. Grams Bromine per Liter. Aq. Layer.	$C_2H_2Cl_4$ Layer.	Water and Pentachlorethane. Gms. Bromine per Liter. Aq. Layer.	$C_2H.Cl_5$ Layer.
0.216	6.47	0.402	10.70
0.592	18.20	0.670	18.29
0.944	29.46	0.864	23.49
1.348	41.65	1.300	35.46
2.444	74.57	2.408	67.44

DATA FOR THE DISTRIBUTION OF BROMINE BETWEEN AQUEOUS SALT SOLUTIONS AND ORGANIC SOLVENTS ARE GIVEN BY THE FOLLOWING INVESTIGATORS:

Immiscible Solvents.	t°.	Authority.
Aqueous $CdBr_2+CCl_4$	25	(Van Name and Brown, 1917.)
Aqueous $CdBr_2.2KBr+CCl_4$	25	" "
Aqueous $HBr+CCl_4$	25	(Lewis and Storch, 1917.)
Aqueous $HgBr_2+CCl_4$	25	(Herz and Paul, 1914; Van Name and Brown, 1917.)
Aqueous $HgBr_2.2KBr+CCl_4$	25	(Van Name and Brown, 1917.)
Aqueous $KBr+CCl_4$	0	(Jones and Hartmann, 1916.)
Aqueous $KBr+CS_2$	32.6	(Roloff, 1894.)

BROMOFORM $CHBr_3$.

100 cc. H_2O dissolve 0.125 gm. $CHBr_3$ at 15°–20°. (Squire and Caines, 1905.)

SOLUBILITY (Freezing-point lowering data, see footnote, p. 1) FOR MIXTURES OF:

Bromoform and Liquid Carbon Dioxide. (Büchner, 1905–06)

t°.	Gms. $CHBr_3$ per 100 Gms. CH_3Br+CO_2.
−31	0
−32	3.7
−30	4.9
−16	13.5
− 8	24
− 5	35.2–67.7 quad. pt.
− 3.5	92.1

Bromoform and Toluene. (Baud, 1912.)

t° of Freezing.	Gms. $CHBr_3$ per 100 Gms. $CHBr_3+C_6H_5.CH_3$.	Solid Phase.
+ 7.7	100	$CHBr_3$
−11.4	86.6	"
−22.2	75.6	"
−30.9	69.8	"
−48.5	60.3	"

BRUCINE $C_{21}H_{20}(OCH_3)_2N_2O_2.4H_2O$.

SOLUBILITY OF BRUCINE IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. Brucine per 100 Gms. Sat Sol.	Authority.
Water	18–22	0.056–0.125	(Müller, 1903; Squire and Caines, 1905; Zalai, 1910.)
Aniline	20	12	(Scholtz, 1912)
Benzene	18–22	1.11–1 86	(Muller, 1903; Schaefer, 1913.)
Carbon Tetrachloride	18–22	0.08	" "
" "	20	1.96	(Schindelmeiser, 1901; Gori, 1913.)
Chloroform	25	11.6	(Schaefer, 1913.)
Trichlor Ethylene	15	2.5	(Wester and Bruins, 1914.)
Ether	18–22	0.75	(Müller, 1903.)
Ethyl Acetate	18–22	4.26	"
Ethyl Alcohol	25	45.2	(Schaefer, 1913.)
Diethylamine	20	1.6	(Scholtz, 1912.)
Methyl Alcohol	25	55.6	(Schaefer, 1913.)
Petroleum Ether	18–22	0.055–0.088	(Müller, 1903; Zalai, 1910.)
Glycerol	18–22	2.2	(Müller, 1903.)
Pyridine	20	28	(Scholtz, 1912.)
"	20–25	21.9	(Dehn, 1917.)
Aq. 50% Pyridine	20–25	31.6	"
Piperidene	20	1	(Scholtz, 1912.)

Results for the solubility of brucine and brucine sulfate in mixtures of alcohol, chloroform and benzene are given by Schaefer (1913).

BRUCINE Per CHLORATE $C_{21}H_{20}(OCH_3)_2N_2O_2.HClO_4$.

100 gms. $H_2O(+2\%HClO_4)$ dissolve 0.15 gm. of the salt at 18°. (Hofmann, Roth, Höbold and Metzler, 1910.)

BRUCINE SULFATE.

100 cc. methyl alcohol dissolve 0.28 gm. brucine sulfate at 25°. (Schaefer, 1913.)
" ethyl " " 1.66 " " " " (Schaefer, 1913.)
" chloroform " 0.6 " " " " (Schaefer. 1913.)

BRUCINE *d, l,* and *i* **TARTRATE.**

SOLUBILITY OF EACH OPTICAL ISOMER IN WATER (Dutilh, 1912.)

t°.	Gms. per 100 Gms. Water.		
	d Tartrate.	*l* Tartrate.	Racemic Tartrate.
20	...	...	1.38
25	1.008	1.84	...
35	1.272	3.24	...
44	1.590	4.64	...
50	1.854	6.56	...

BUTANE C_4H_{10}.

SOLUBILITY IN WATER AT t° AND 760 MM.

t°.	0°.	4°.	10°.	15°.	20°.
Vol. C_4H_{10} per 100 vols. H_2O	3.147	2.77	2.355	2.147	2.065

Diphenyl**BUTADIENE.**

Freezing-point curves (solubility, see footnote, p. 1), are given by Pascal (1914) for mixtures of diphenylbutadiene and each of the following compounds: diphenyldiacetylene, diphenylhydrazine and cinnamylidene.

BUTYL ACETATE $CH_3.CO_2.C_4H_9$.

SOLUBILITY OF BUTYL ACETATE AND OF BUTYL FORMATE IN MIXTURES OF ALCOHOL AND WATER.

(Bancroft — Calc. from Pfeiffer — Phys. Rev. 3, 205, '95–'96.)

cc. Alcohol in Mixture.	cc. H_2O added to cause separation of a second phase in mixtures of the given quantity of alcohol and 3 cc. portions of:	
	Butyl Formate.	Butyl Acetate.
3	3.45	2.08
6	8.83	6.08
9	14.75	10.46
12	21.45	15.37
15	29.65	20.42
18	39.0	25.60
21	51.8	31.49
24	∞	37.48
27		43.75
30		50.74
33		59.97

100 cc. H_2O dissolve 0.7 cc. isobutyl acetate at 25°. (Bancroft.)

Iso**BUTYL ACETATE,** etc.

SOLUBILITY IN WATER. (Traube, 1884; at 20°, Vaubel, 1899.)

t°.	Compound.	Grams Compound per 100 Grams H_2O.
22	Iso Butyl Acetate	0.5
22	Iso Butyl Formate	1.0
20	Normal Butyric Aldehyde	3.6
20	Iso Butyric Aldehyde	10.0

Secondary **BUTYL ALCOHOL** $CH_3.CHOH.CH_2CH_3$.
Iso **BUTYL ALCOHOL** $(CH_3)_2CH.CH_2OH$.

SOLUBILITY OF BUTYL ALCOHOLS IN WATER, "SYNTHETIC METHOD."
(see Note, p. 16).
(Alexejew, 1886.)

	Secondary Butyl Alcohol and Water. Gms. Secondary Butyl Alcohol per 100 Gms.		Iso Butyl Alcohol and Water. Gms. Iso Butyl Alcohol per 100 Gms.	
t°.	Aqueous Layer.	Alcoholic Layer.	Aqueous Layer.	Alcoholic Layer.
−20	27	66	...	...
−10	28	60	...	...
0	27.5	56	13	85
10	26.0	57	...	...
20	22.5	60	9	84
30	18	63.5	...	...
40	16	65.5	7.5	83
60	13	67	7	82
80	15	63	7	77.5
100	20	52	8	72
107 crit. temp.	33		...	...
120			16	62
130			28	50
133 crit. temp.			49	

Additional determinations of the reciprocal solubility of secondary butyl alcohol and water are given by Dolgolenko (1908). This investigator prepared three fractions of 98°–98.6°, 98.6°–99° and 99°–99.5° boiling point respectively, and determined the curve for each fraction and water by the "synthetic method." The first fraction gave a closed curve having both a lower and an upper critical solution temperature, while the other fractions gave curves with only an upper critical solution temperature, and in other respects in fair agreement with the results of Alexejew as shown in the above table. The explanation of this difference in the case of the first fraction, is supposed to be that this fraction contained a larger proportion of tertiary butyl alcohol than the others, due to the lower boiling point of this isomer. Since the tertiary alcohol is entirely miscible with secondary alcohol and water its presence would restrict the boundaries of inhomogeneity and, therefore, tend to favor a closed curve for the system.

SOLUBILITIES, DETERMINED BY THE FREEZING-POINT METHOD (see footnote, p. 1), ARE GIVEN FOR THE FOLLOWING MIXTURES CONTAINING BUTYL ALCOHOLS.

Isobutyl alcohol + Water	(Dreyer, 1913.)
" " + Liquid CO_2	(Büchner, 1905–06.)
Normal butyl alcohol + Water	(Dreyer, 1913.)
" " " + Liquid CO_2	(Büchner, 1905–06.)
Secondary butyl alcohol + Water	(Dreyer, 1913; Timmermans, 1907, 1910, 1911.)
" " " + " + Hydroquinine	(Timmermans, 1907.)
Tertiary butyl alcohol + Water.	(Dreyer, 1913.)

DISTRIBUTION OF ISOBUTYL ALCOHOL BETWEEN WATER AND COTTON SEED OIL AT 25°. (Wroth and Reid, 1916.)

Gms. C_4H_9OH per 100 cc. Oil Layer.	H_2O Layer.	Ratio.	Gms. C_4H_9OH per 100 cc. Oil Layer.	H_2O Layer.	Ratio
1.168	2.043	1.74	1.375	2.301	1.67
1.276	2.250	1.76	1.405	2.429	1.72
1.288	2.135	1.65	1.495	2.450	1.64

The partition coefficient of tertiary butyl alcohol $(CH_3)_2C(OH)CH_3$, between olive oil and water is given as 0.176 at ord. temp. (Baum, 1899.)

IsoBUTYLAMINE HYDROCHLORIDE $(CH_3)_2CHCH_2NH_2.HCl$.

100 gms. H_2O dissolve 238.9 gms. of the salt at 25°. (Peddle and Turner, 1913.)
100 gms. $CHCl_3$ dissolve 11.56 gms. of the salt at 25°. (Peddle and Turner, 1913.)

BUTYLCHLORAL $CH_3CHCl.CCl_2CHO$.

The distribution coefficient of butylchloral between oil and water is given as 1.6. (Meyer, 1907.)

BUTYLCHLORALHYDRATE $CH_3CHCl.CCl_2.CH(OH)_2$.

100 gms. H_2O dissolve 2.7 gms. butylchloralhydrate at 15.5° (Greenish and Smith, 1903.)
" " " 2.3 " " at 15°-20°. (Squire and Caines, 1905.)
" glycerol " 100 " " at 15°-20°. (Greenish and Smith, 1903.)

The partition coefficient of butylchloralhydrate between olive oil and water is given as 1.589 at ord. temp. (Baum, 1899.)

BUTYRIC ACIDS (normal) $CH_3(CH_2)_2COOH$; (iso) $(CH_3)_2CH.COOH$.

SOLUBILITY OF NORMAL BUTYRIC ACID IN WATER, DETERMINED BY THE FREEZING-POINT METHOD. (Faucon, 1909, 1910.)

t° of Congealing.	Gms. Acid per 100 Gms. Mixture.	t° of Congealing.	Gms. Acid per 100 Gms. Mixture.	t° of Congealing.	Gms. Acid per 100 Gms. Mixture
0	0	− 3.57	67.38	−13.40	87.62 Eutec.
−1.08	5.12	− 5.20	75	−12.40	90.08
−2.70	12.75	− 6.80	80	−10	95.92
−2.96	25.32	− 8.61	84	− 8	98.60
−3.07	50.60	−10.25	85.41	− 5.40	99.15
−3.14	59.72	−12.54	86.54	− 3.12	100

Higher values for the temperature of congealing of the above mixtures are given by Ballo (1910). For additional data see also Timmermans (1907) and Tsakalotos (1914). Data for the miscibility of normal butyric acid and water are also given by Faucon. The curve is entirely in the metastable region. The mixtures are either opalescent or completely homogeneous and never form two distinct layers, even with the application of centrifugal force. The results are as follows:

t° of opalescence	−5.2	−4.2	−4	−3.8 crit. t.	−4.5	−7
Gms. acid per 100 gms. mixture	25	30	35	40	50	58.2

SOLUBILITY OF ISOBUTYRIC ACID IN WATER, DETERMINED BY THE FREEZING-POINT METHOD. (Faucon, 1910)

The congealing temperatures for mixtures containing up to 60 grams isobutyric acid per 100 gms. coincide with the results given in the above table for normal butyric acid and water. For higher concentrations the following results were obtained.

t° of congealing	−3.09	−3.35	−3.61	−12.5	−80
Gms. acid per 100 gms. mixture	70.10	82.08	86.44	97.21	100

MISCIBILITY OF ISOBUTYRIC ACID AND WATER, DETERMINED BY THE "SYNTHETIC METHOD."

(Smirnoff, 1907.)

t°.	Gms Acid per 100 Gms.: Upper Layer.	Lower Layer.
10.05	69.08	17.82
12	67.1	18.3
14	64.9	19.1
16	62.3	20
18	59.2	21.1
20	55.4	22.8
22	49	25.8
22.5	46	27
23	41	29
23.3 crit. t.	34.7	

Determinations varying more or less from the above are given by Rothmund (1898), Friedlander (1901) and Faucon (1910). The discrepancies are shown by Smirnoff to be due to the effect of variations in purity of the isobutyric acid upon the position of the curve. Smirnoff fractionated the purest obtainable acid and determined the miscibility curve for each fraction. The above results were obtained with fraction 4 of boiling point 154°–155°, twice refractionated.

An extensive series of determinations are given by Smirnoff of the effect of various percentages of different salts upon the temperature of immiscibility of aqueous 16.46% isobutyric acid solution.

DISTRIBUTION OF BUTYRIC ACID BETWEEN WATER AND BENZENE AT 13°–15°

(Georgievics, 1913)

Gms. Butyric Acid Used.	Gms. Acid Found per: 150 cc. Benzene Layer.	25 cc. H_2O Layer.
2.0044	1.7643	0.2401
2.9968	2.6965	0.3003
3.5028	3.1740	0.3288
4.0088	3.6544	0.3544
4.5342	4.1521	0.3821

The distribution ratio of normal butyric acid between water and benzene at room temperature was found by King and Narracott (1909), to be 1 to 0.7585, and for isobutyric acid, the ratio was 1 to 0.810.

One determination of the distribution of butyric acid between sat. aqueous $CaCl_2$ solution and kerosene gave 7.2 gms. acid per 100 gms. aqueous layer and 92.8 gms. per 100 gms. kerosene layer at ord. temp. (Crowell, 1918.)

DATA FOR THE FOLLOWING TERNARY SYSTEMS CONTAINING NORMAL BUTYRIC ACID ARE GIVEN BY TIMMERMANS, 1907.

Normal Butyric acid + Water + Azobenzene.
" " " " + Barium nitrate.
" " " " + Benzophenone.
" " " " + Camphor.
" " " " + Cane sugar.
" " " " + Mannite.
" " " " + Naphthalene.
" " " " + Potassium sulfate.
" " " " + Sodium chloride.

Freezing-point data are given for mixtures of *n* butyric acid and formamide by English and Turner (1915), and for mixtures of trichlorobutyric acid and dimethyl pyrone by Kendall (1914).

CADMIUM BROMIDE $CdBr_2$.

SOLUBILITY IN WATER.

(Dietz — Ber. 32, 95, '99; Z. anorg. Chem. 20, 260, '99; Wiss Abh p t. Reichanstalt. 3, 433, '00; see also Eder — Dingler polyt. J. 221, 189, '76; Etard — Ann. chim. phys. [7] 2, 536, '94.)

t°.	Gms. $CdBr_2$ per 100 Gms. Solution.	Mols. $CdBr_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $CdBr_2$ per 100 Gms. Solution.	Mols. $CdBr_2$ per 100 Mols. H_2O.	Solid Phase.
0	37.92	4.04	$CdBr_2.4H_2O$	40	60.65	10.20	$CdBr_2.H_2O$
18	48.90	6.21	"	45	60.75	10.24	"
30	56.90	8.73	"	60	61.10	10.39	"
38	61.84	10.73	"	80	62.29	10.48	"
35	60.29	10.05	$CdBr_2.H_2O$	100	61.63	10.63	"

Density of saturated solution at 18° = 1.683.

SOLUBILITY OF CADMIUM BROMIDE IN ALCOHOL, ETHER, ETC.

100 gms. sat. solution of $CdBr_2.4H_2O$ in abs. alcohol contain 20.93 gms. $CdBr_2$ at 15°. (Eder)

100 gms. sat. solution of $CdBr_2.4H_2O$ in abs. ether contain 0.4 gm. $CdBr_2$ at 15°. (Eder.)

100 gms. absolute acetone dissolve 1.559 gms. $CdBr_2$ at 18°. $d_{\frac{18}{4}}$ sat. sol. = 0.8073. (Naumann, 1904.)

100 gms. benzonitrile dissolve 0.857 gm. $CdBr_2$ at 18°. (Naumann, 1914.)

100 gms. anhydrous hydrazine dissolve 40 gm. $CdBr_2$ at room temp. (Welsh and Broderson, 1915)

RECIPROCAL SOLUBILITIES, DETERMINED BY THE METHOD OF LOWERING OF THE FREEZING-POINT (see footnote, p. 1), ARE GIVEN FOR THE FOLLOWING MIXTURES:

Cadmium Bromide	+ Cadmium Chloride	(Nacken, 1907; Ruff and Plato, 1903.)
" "	+ Cadmium Iodide	(Nacken, 1907)
" "	+ Calcium Fluoride	(Ruff and Plato, 1903)
" "	+ Cuprous Bromide	(Herrmann, 1911.)
" "	+ Potassium Bromide	(Brand, 1913.)
" "	+ Sodium Bromide	"
" "	+ " " + Potassium Bromide	"

CADMIUM (Mono)AMMONIUM BROMIDE $CdBr_2.NH_4Br$

SOLUBILITY IN WATER.

(Rimbach, 1905; Eder.)

t°.	100 Grams Solution contain Gms. Cd.	Br.	NH_4.	Atomic Relation. Cd	: Br	: NH_4.	G. $CdBr_2NH_4Br$ per 100 Gms. Solution.
1.0	16.33	34.87	2.63	1	3	1	53.82
14.8	17.40	37.15	2.80	1	3	1	58.01
52.2	19.79	42.38	3.21	1	3	1	65.31
110.1	22.99	49.17	3.72	1	3	1	75.98

100 gms. sat. solution of $CdBr_2.NH_4Br$ in abs. alcohol contain 15.8 gms. double salt at 15° (Eder).

100 gms. sat. solution of $CdBr_2.NH_4Br$ in abs. ether contain 0.36 gm. double salt at 15° (Eder).

CACODYLIC ACID $(CH_3)_2AsO.OH$.

100 cc. H_2O dissolve about 200 gms. cacodylic acid at 15°. (Squire and Caines, 1905.)

100 cc. 90% alcohol dissolve about 28.5 gms. cacodylic acid at 15°. " "

CADMIUM (Tetra) AMMONIUM BROMIDE $CdBr_2.4NH_4Br$.

SOLUBILITY IN WATER.

(Rimbach.)

The double salt is decomposed by water at temperatures below 160°.

t°.	100 Gms. Solution contain Gms.			Atomic Relation in Sol.			Atomic Relation in Solid.		
	Cd.	Br.	NH_4.	Cd :	Br :	NH_4.	Cd :	Br :	NH_4
0.8	14.72	50.46	6.67	1	4.82	2.82	1	10.02	8.02
13.0	14.95	51.48	6.85	1	4.85	2.85	1	11.57	9.57
44.0	15.01	53.85	7.35	1	5.04	3.04	1	6.84	4.84
76.4	14.6	55.28	7.80	1	5.32	3.32	1	6.63	4.63
123.5	15.5	59.50	8.45	1	5.38	3.38	1	7.40	5.40
160.0	14.7	62.67	9.43	1	5.99	3.99	1	6.03	4.03

CADMIUM (Mono) POTASSIUM BROMIDE $CdBr_2.KBr.H_2O$.

SOLUBILITY IN WATER.

(Rimbach; see also Eder.)

t°.	100 Gms. Solution contain Gms.			Atomic Relation in Sol.			Gms. $CdBr_2$ KBr per 100 Gms. Solution.
	Cd.	Br.	K.	Cd :	Br :	K.	
0.4	15.41	33.0	5.42	1	3	1	53.63
15.8	16.85	35.96	5.86	1	3	1	58.61
50.0	19.58	41.86	6.85	1	3	1	67.87
112.5	22.24	48.28	8.14	0.98	3	1.03	78.11

CADMIUM Tetra**POTASSIUM BROMIDE** is decomposed by water at ordinary temperatures.

CADMIUM (Mono)RUBIDIUM BROMIDE $CdBr_2.RbBr$.

SOLUBILITY IN WATER.

(Rimbach.)

t°.	100 Gms. Solution contain Gms.			Atomic Relation in Sol.			Gms. $CdBr_2.RbBr$ per 100 Gms. Solution.
	Cd.	Br.	Rb.	Cd :	Br .	Rb	
0.4	8.37	17.93	6.43	1	3	1.01	32.65
14.5	10.72	23.02	8.30	0.99	3	1.01	41.87
49.2	15.01	32.13	11.51	1	3	1	58.54
107.5	19.65	41.12	14.06	1.02	3	0.96	75.77

CADMIUM (Tetra)RUBIDIUM BROMIDE $CdBr_2.4RbBr$.

SOLUBILITY IN WATER.

(Rimbach.)

t°.	100 Gms. Solution contain Gms.			Atomic Relation in Sol.			Gms. $CdBr_2.4RbBr$ per 100 Gms. Solution.
	Cd	Br	Rb.	Cd :	Br ·	Rb	
0.5	5.70	24.94	17.97	0.98	6	4.05	47.95
13.5	6.55	28.74	20.74	0.97	6	4.05	55.17
51.5	8.25	35.51	25.39	0.99	6	4.02	68.82
114.5	9.50	40.67	29.00	1.00	6	4.0	79.04

CADMIUM (Mono) **SODIUM BROMIDE** $CdBr_2.NaBr2\frac{1}{2}H_2O$.

SOLUBILITY IN WATER, ETC., AT 15°.

(Eder — Ding. polyt. J. 221, 189, '76.)

Solvent.	Gms. $CdBr_2$ NaBr per 100 Gms. Solution.	Solvent.	Solid Phase.
Water	49.0	96.1	$CdBr_2.NaBr.2\frac{1}{2}H_2O$
Absolute Alcohol	21.2	27.0	"
Absolute Ether	0.52	0.53	"

CADMIUM CHLORATE $Cd(ClO_3)_2.2H_2O$.

SOLUBILITY IN WATER.

(Meusser, 1902.)

t°.	Gms. $Cd(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Cd(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Cd(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Cd(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.
− 6.5	26.18	3.07	Ice	± 0	74.95	25.92	$Cd(ClO_3)_2.2H_2O$
−13.0	52.36	9.52	"	18	76.36	27.98	"
−20.0	72.10	22.47	$Cd(ClO_3)_2.2H_2O$	49	80.08	34.82	"
−15.0	72.53	22.87	"	65	82.95	42.14	"

Density of the sat. solution at 18° = 2.284.

CADMIUM CHLORIDE $CdCl_2.2\frac{1}{2}H_2O$.

SOLUBILITY IN WATER.

(Dietz — W. Abh. p. t. Reichanstalt 3, 433, '00; above 100°, Etard — Ann. chim. phys. [7] 2, 536, '94.)

t°.	G. $CdCl_2$ per 100 Gms. Solution.	Mols. $CdCl_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	G. $CdCl_2$ per 100 Gms. Solution.	Mols. $CdCl_2$ per 100 Mols. H_2O.	Solid Phase.
− 9	43.58	7.5	$CdCl_2.4H_2O$	+10	57.47	13.3	$CdCl_2.H_2O$
0	49.39	9.6	"	20	57.35	13.2	"
+10	55.58	12.3	"	40	57.51	13.3	"
15	59.12	14.2	"	60	57.71	13.4	"
−10	44.35	7.8	$CdCl_2.2\frac{1}{2}H_2O$ (monoclinic)	80	58.41	13.8	"
0	47.37	9.0	"	100	59.52	14.4	"
+18	52.53	10.9	"	150	64.8		
30	56.91	12.8	"	200	72.0		
36	57.91	13.5	"	270	77.7		

Density of saturated solution at 18° = 1.741.

100 gms. abs. ethyl alcohol dissolve 1.52 gms. $CdCl_2$ at 15°.5.
100 gms. abs. methyl alcohol dissolve 1.71 gms. $CdCl_2$ at 15°.5. (de Bruyn, 1892.)
100 gms. abs. methyl alcohol dissolve 1.5 gms. $CdCl_2$ at the crit. temp. (Centnerszwer, 1910.)
100 gms. benzonitrile dissolve 0.063 gm. $CdCl_2$ at 18°. (Naumann, 1914.)

RECIPROCAL SOLUBILITIES, DETERMINED BY THE METHOD OF LOWERING OF THE FREEZING-POINT (see footnote, p. 1), ARE GIVEN FOR THE FOLLOWING MIXTURES:

Cadmium Chloride + Cadmium Iodide (Nacken, 1907 (c); Ruff and Plato, 1903.)
" " + Cadmium Fluoride (Ruff and Plato, 1903)
" " + Cadmium Sulfate " "
" " + Calcium Chloride (Sandonnini, 1911, 1914; Menge, 1911.)
" " + Cuprous Chloride (Herrmann, 1911.)
" " + Lead Chloride (Sandonnini, 1912, 1914; Herrmann, 1911.)
" " + Magnesium Chloride (Menge, 1911.)
" " + Manganese Chloride (Sandonnini, 1914; Sandonnini and Scarpa, 1911.)
" " + Mercuric Iodide (Sandonnini, 1912.)
" " + Potassium Chloride (Brand, 1911.)
" " + Sodium Chloride "
" " + " " + Potassium Chloride (Brand, 1911.)
" " + Strontium Chloride (Sandonnini, 1911; 1914.)
" " + Thallium Chloride (Korreng, 1914; Sandonnini, 1913.)
" " + Tin (ous) Chloride (Herrmann, 1911; Sandonnini, 1914.)
" " + Zinc Chloride (Herrmann, 1911.)

CADMIUM AMMONIUM CHLORIDE $CdCl_2.NH_4Cl$.

SOLUBILITY IN WATER.
(Rimbach — Ber. 30, 3075, 1897.)

t°.	100 Gms. Solution contain Gms.			Gms. $CdCl_2.NH_4Cl$ per 100 Gms.	
	Cd.	Cl.	NH$_4$.	Solution.	Water.
2.4	14.26	13.44	2.24	29.94	42.74
16.0	15.82	15.07	2.56	33.45	50.26
41.2	18.61	17.46	2.89	38.96	63.83
63.8	20.92	19.73	3.34	43.99	78.54
105.9	24.70	23.52	4.01	52.23	109.33

CADMIUM (Tetra) AMMONIUM CHLORIDE $CdCl_2.4NH_4Cl$.

IN CONTACT WITH WATER.

The salt is decomposed in aqueous solution.
(Rimbach.)

t°.	100 Gms. Solution contain Gms.			Atomic Relation in Solution.		
	Cd.	Cl.	NH$_4$.	Cd	Cl	NH$_4$.
3.9	5.75	18.17	7.37	1	9.96	7.96
16.1	6.96	20.26	7.97	1	9.20	7.13
40.2	9.91	23.84	8.92	1	7.61	5.61
58.5	12.50	26.53	9.35	1	6.71	4.66
112.9	16.66	31.79	10.78	1	6.02	4.02
113.9	16.51	32.71	11.30	1	6.26	4.26

SOLUBILITY OF MIXTURES OF CADMIUM TETRA AMMONIUM CHLORIDE AND CADMIUM AMMONIUM CHLORIDE IN WATER.
(Rimbach — Ber. 35, 1300, '02.)

t°.	100 Gms. Solution contain Gms.			Atomic Relation.			Solid Phase, Mol. per cent of:	
	Cd.	Cl.	NH$_4$.	Cd	Cl	NH$_4$.	$CdCl_2.NH_4Cl$.	$CdCl_2.4NH_4Cl$.
1.1	5.34	17.62	7.27	1	10.47	8.50	49.6	50.4
14.0	7.12	19.86	7.84	1	8.84	6.87	47.0	53.0
40.7	10.24	23.82	8.85	1	7.37	5.37	77.0	23.0
58.5	12.50	26.53	9.35	1	6.71	4.66	...	...

Solubility of Mixtures of Cadmium Tetra Ammonium Chloride and Ammonium Chloride in Water.

(Rimbach.)

t°.	100 Gms. Solution contain Gms.			Atomic Relation.			Solid Phase, Mol. per cent of:	
	Cd.	Cl.	NH.	Cd	: Cl	: NH_4.	NH_4Cl.	$CdCl_2.4NH_4Cl$.
1.0	2.82	17.11	7.82	1	19.21	17.28	59.0	41.0
13.2	2.76	18.84	8.71	1	21.62	19.62	74.0	26.0
40.1	3.16	22.56	10.49	1	22.65	20.74	71.0	29.0
58.2	3.51	25.21	11.72	1	22.79	20.89	69.0	31.0

CADMIUM BARIUM CHLORIDE $2(CdCl_2).BaCl_2.5H_2O$.

Solubility in Water.

(Rimbach — Ber. 30, 3083, '97.)

t°.	100 Gms. Solution contain Gms.			Gms. $2(CdCl_2)$ $BaCl_2$ per 100 Gms.	
	Cd.	Cl.	Ba.	Solution.	Water.
22.6	17.71	16.89	11.0	45.60	83.82
41.3	19.22	18.15	11.77	49.14	96.62
53.9	19.85	18.75	12.41	51.04	104.25
62.2	20.59	19.66	12.83	53.08	113.13
69.5	21.20	20.18	13.09	54.47	119.64
107.2	24.25	23.23	14.90	62.38	165.85

CADMIUM BARIUM CHLORIDE $CdCl_2.BaCl_2.4H_2O$.

Solubility in Water.

(Rimbach.)

t°.	100 Gms. Solution contain Gms.			Gms. $CdCl_2$ $BaCl_2$ per 100 Gms.	
	Cd.	Cl.	Ba.	Solution.	Water.
22.5	11.98	15.19	14.71	41.88	72.06
32.9	12.40	16.18	16.09	44.67	80.73
41.4	13.05	16.95	16.81	46.81	88.01
53.4	13.96	18.21	18.13	50.30	101.21
62.0	14.73	18.81	18.74	52.28	109.56
97.8	17.57	22.48	22.00	62.05	163.50
108.3	18.53	23.51	22.79	64.83	184.33
109.2	18.67	23.69	29.95	65.31	188.27

CADMIUM MAGNESIUM CHLORIDE $2(CdCl_2)MgCl_2.12H_2O$.

Solubility in Water.

(Rimbach.)

t°.	100 Gms. Solution contain Gms.			Gms. $2(CdCl_2).MgCl_2$ per 100 Gms.	
	Cd.	Cl.	Mg.	Solution.	Water.
2.4	22.14	21.06	2.41	45.61	83.86
20.8	24.30	22.80	2.55	49.69	98.77
45.5	26.24	24.55	2.72	53.51	115.10
67.2	28.45	26.71	2.98	58.14	138.90
121.8	31.84	30.20	3.44	65.48	189.69

CADMIUM (Mono)RUBIDIUM CHLORIDE $CdCl_2.RbCl$.

SOLUBILITY OF CADMIUM MONORUBIDIUM CHLORIDE IN WATER.
(Rimbach, 1902.)

t°.	100 Gms. Solution contain Gms.			Gms $CdCl_2.RbCl$ per 100 Gms.	
	Cd.	Cl.	Rb.	Solution.	Water.
1.2	4.80	4.53	3.63	12.97	14.90
14.5	6.20	5.88	4.75	16.80	20.19
41.4	9.34	8.86	7.14	25.31	33.89
57.6	11.40	10.78	8.63	30.83	44.58
103.9	17.14	16.37	13.39	46.62	87.36

CADMIUM (Tetra)RUBIDIUM CHLORIDE $CdCl_2.4RbCl$.

IN CONTACT WITH WATER.
(Rimbach.)

The double salt decomposes to $CdCl_2.RbCl$ and RbCl.

t°.	100 Gms. Solution contain Gms.			Atomic Relation.			Solid Phase, Mol. per cent of:	
	Cd.	Cl.	Rb.	Cd	: Cl	: Rb.	$CdCl_2.RbCl$.	$CdCl_2.4RbCl$.
0.7	0.65	6.52	14.73	1	31.88	29.88	30	70
8.8	1.07	7.37	16.13	1	21.89	19.89	24	76
13.8	1.32	7.86	16.93	1	18.88	16.83	16	84
42.4	3.21	11.35	22.45	1	11.21	9 21	14	86
59.0	4.61	13.41	25.31	1	9.23	7.23	33	67
108.4	8.94	18.57	31.15	1	6.57	4.59	..	..

SOLUBILITY OF MIXTURES OF $CdCl_2.4RbCl$ AND RbCl IN WATER.
(Rimbach.)

t°.	100 Gms. Solution contain Gms.			Atomic Relation.			Solid Phase, Mol. per cent of:	
	Cd.	Cl.	Rb.	Cd	: Cl	: Rb.	$CdCl_2.4RbCl$	RbCl.
0.4	..	12.86	30.97	..	1	1	55	45
14.8	..	13.62	32.81	..	1	1	67	33
17.9	..	14.0	33.71	..	1	1	80	20

THE EFFECT OF THE PRESENCE OF HCl, $CaCl_2$ AND OF LiCl UPON THE DECOMPOSITION OF CADMIUM TETRARUBIDIUM CHLORIDE BY WATER AT 16°.
(Rimbach, 1905.)

100 Gms. Solution contain Gms.					Mols. per 100 Mols. H_2O.			Molecular Ratio.	
Total Cl.	Cl.	HCl.	Cd.	Rb.	$CdCl_2$.	RbCl.	HCl	$CdCl_2$:	RbCl.
36.44	0.84	36.61	0.41	1.39	0.109	0.483	29.76	1	4.43
28.45	0.80	28.44	0.35	1.38	0.082	0.422	20.35	1	5.15
12.09	3.24	9.11	0.69	6.74	0.139	1.772	5.60	1	12.75
	Ca.	$CaCl_2$.					$CaCl_2$.		
14.98	7.56	20.91	0.73	2.80	0.159	0.799	4.59	1	5.04
12.70	5.77	15.96	0.77	4.87	0.163	1.353	3.41	1	8.31
10.85	3.78	14.47	1.00	8.51	0.211	2.365	2.24	1	11.22
9.08	1.84	5.10	1.24	12.14	0.262	3.385	1.09	1	12.92
	Li.	LiCl.					LiCl.		
26.49	4.87	29.40	0.56	3.871	0.139	1.271	19.40	1	9.13
20.37	3.33	20.11	0.52	7.84	0.122	2.433	12.54	1	19.88

See Note on next page.

CADMIUM (Mono) POTASSIUM CHLORIDE $CdCl_2.KCl.H_2O$.

SOLUBILITY IN WATER.

(Rimbach — Ber. 30, 3079, '97; see also Croft — Phil. Mag. [3] 21, 356, '42.)

t°.	100 Gms. Solution contain Gms. Cd.	Cl.	K.	Gms. $CdCl_2.KCl$ per 100 Gms. Solution.	Water.
2.6	9.53	9.03	3.31	21.87	27.99
15.9	11.63	10.98	3.99	26.60	36.24
41.5	15.47	14.73	5.45	35.66	55.34
60.6	17.68	16.80	6.20	40.67	68.55
105.1	22.46	21.34	7.87	51.67	106.91

CADMIUM (Tetra) POTASSIUM CHLORIDE $CdCl_2.4KCl$.

IN CONTACT WITH WATER.

(Rimbach)

The double salt is decomposed when dissolved in water at ordinary temperature.

t°.	100 Grams Solution contain Gms. Cd.	Cl.	K.
4	3 64	9.84	8.31
23.6	5.66	14 02	11.52
50.2	9.10	18.09	13.60
108.9	11.94	23.11	17.16

NOTE. — The effect of the presence of certain chlorides upon the decomposition of cadmium tetra potassium chloride by water at 16° was investigated by Rimbach in a manner similar to that used in the case of cadmium tetra rhubidium chloride (see preceding page). The results, which show the extent to which increasing amounts of the several chlorides force back the decomposition of the double salt, were plotted on cross-section paper, and the points at which the decomposition was prevented, were determined by interpolation. These values which show the minimum amount of the added chlorides which must be present to insure the crystallization of the pure double salt are shown in the following table.

Added Chloride.	Mols. per 100 Mols. H_2O. $CdCl_2$.	KCl.	Added Chloride.	Density of Solutions.	Mols. per Liter of Solution. $CdCl_2$.	KCl.	Added Chloride.
HCl	0.074	0.296	19.80	1.1403	0.033	0.132	8.828
LiCl	0.344	1.376	9.30	1.1380	0.166	0.663	4.483
$CaCl_2$	0.544	2.176	3.80	1.2333	0.270	1.080	1.887
KCl	1.034	6.514*	2.378	1.214	0.507	3.195*	1.167

* Total.

SOLUBILITY OF CADMIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT SEVERAL TEMPERATURES AND VICE VERSA. (Sudhaus, 1914.)

Gms. per 100 gms. H_2O. $CdCl_2$.	KCl.	Solid Phase.
Results at 19.3°.		
111.3	0.0	$CdCl_2.2\frac{1}{2}H_2O$
59.59	6.7	" $+ D_{1.1.1}$
*26.98	11.09	$D_{1.1.1}$
11.61	30.04	" $+D_{1.4}$
1.44	34.76	$D_{1.4}+KCl$
0.0	33.94	KCl
Results at 29.7°.		
129.65	0.0	$CdCl_2.2\frac{1}{2}H_2O$
97.62	0.70	"
68.23	7.08	"$+D_{1.1.1}$
47.12	9.89	$D_{1.1.1}$
*32.67	13.06	"
24.26	16.10	"
15.99	25.97	"
15.47	33.58	" $+D_{1.4}$
2.42	37.66	$D_{1.4}+KCl$
0.0	37.21	KCl

Gms. per 100 gms. H_2O. $CdCl_2$.	KCl.	Solid Phase.
Results at 40.1°.		
133.85	0.0	$CdCl_2.H_2O$
92.15	2.70	" $+ D_{1.1.1}$
51.90	11.50	$D_{1.1.1}$
*37.91	15.21	"
24.45	21.73	"
18.97	35.51	"
19.92	37.63	" $+D_{1.4}$
2.98	40.45	$D_{1.4}+KCl$
0.0	40.36	KCl
Results at 54.5.		
133.9	0.0	$CdCl_2.H_2O$
102.15	2.32	" $+D_{1.1.1}$
*44.01	18.39	$D_{1.1.1}$
26.13	43.78	" $+D_{1.4}$
4.20	45.52	$D_{1.4}+KCl$
0.0	43.00	KCl

$D_{1.1.1} = CdCl_2.KCl.H_2O$, $D_{1.4} = CdCl_2.4KCl$.

* Shows the solubility of the double salt in water.

SOLUBILITY OF THE DOUBLE SALT. $CdCl_2.4KCl$ IN WATER. (Sudhaus, 1914.)

t°.	Gms. $CdCl_2$ 4KCl per 100 gms H_2O.	Mol Ratio in Solution.
19.3	41.65	$1CdCl_2$: 6.37 KCl
23.6	45.35	" : 5.85 "
29.7	49.05	" : 5.34 "
40.1	57.55	" : 4.60 "
50.2	68 89	" : 4.30 "
54.5	69.91	" : 4.12 "

SOLUBILITY OF CADMIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT SEVERAL TEMPERATURES AND VICE VERSA. (Sudhaus, 1914.)

Gms. per 100 gms. H_2O. $CdCl_2$.	$NaCl$.	Solid Phase.
Results at 19.3°.		
111.30	0.0	$CdCl_2.2\frac{1}{2}H_2O$
116.64	7.52	" $+D_{1.2.3}$
85.15	12.19	$D_{1.2.3}$
*40.01	25.67	"
5.96	36.76	" $+NaCl$
0.0	35.84	$NaCl$
Results at 29.7°.		
132.67	9.63	$CdCl_2.2\frac{1}{2}H_2O+D_{1.2.3}$
123.54	10.10	$D_{1.2.3}$
106.16	12.92	"
91.10	15.41	"

Gms per 100 gms H_2O. $CdCl_2$.	$NaCl$	Solid Phase.
Results at 29.7° (con.).		
*43.74	27.46	$D_{1.2.3}$
9.43	37.54	" $+NaCl$
Results at 40.1°.		
137.03	15.14	$CdCl_2.H_2O+D_{1.2.3}$
*48.17	29.50	$D_{1.2.3}$
13.31	38.16	" $+NaCl$
Results at 54.5°.		
140.42	19.10	$CdCl_2.H_2O+D_{1.2.3}$
*52.76	32.97	$D_{1.2.3}$
22.53	39.07	" $+NaCl$
0.0	36.82	$NaCl$

$D_{1.2.3} = CdCl_2.2NaCl.3H_2O$.

* Shows the solubility of the double salt in water.

CADMIUM CINNAMATES $(C_6H_5CH:CH.COO)_2Cd$.

100 gms. water dissolve 0.070 gm. cadmium cinnamate at 26°. (de Jong, 1909.)
100 " " " 0.56 " cadmium isocinnamate at 20°. (Michael, 1903.)
100 " " " 0.10 " cadmium allocinnamate at 20°. "

CADMIUM CYANIDE $Cd(CN)_2$.

100 gms. H_2O dissolve 1.7 gms. $Cd(CN)_2$ at 15°. (Joannis, 1882)

CADMIUM FLUORIDE CdF_2.

100 cc. of sat. solution in water contain 4.33 gms. CaF_2 at 25°.
100 cc. of sat. solution in 1.08 n. HF contain 5.62 gms. CaF_2 at 25°. (Jaeger, 1901.)
Freezing-point lowering data (solubility, see footnote, p. 1) are given for mixtures of cadmium fluoride and cadmium iodide by Ruff and Plato (1903), and for mixtures of cadmium fluoride and sodium fluoride by Puschin and Baskov, (1913).

CADMIUM HYDROXIDE $Cd(OH)_2$.

Solubility in Water.

1 liter of aqueous solution contains 0.0026 gm. $Cd(OH)_2$ at 25°. (Bodländer, 1898.)

Solubility in Aqueous Ammonium Hydroxide Solutions.

Results at 25°. (Bonsdorff, 1904)		Results at 16–21°. (Euler, 1903.)		
Normality of NH_3.	Gms. $Cd(OH)_2$ per liter.	t°.	Normality of NH_3.	Gms. $Cd(OH)_2$ per liter.
0.5	0.274	16–17	0.47	0.44
1.0	0.707	"	0.87	1.17
1.8	1.516	21	0.26	0.09
4.6	5.609	"	0.51	0.32

CADMIUM IODIDE CdI_2.

Solubility in Water.

(Dietz, 1900; see also Kremers, 1858; Eder, 1876; Etard, 1894)

t°.	Gms. CdI_2 per 100 Gms. Solution.	Gms. CdI_2 per 100 Gms. Water.	Mols. CdI_2 per 100 Mols H_2O.	t°.	Gms. CdI_2 per 100 Gms. Solution.	Gms. CdI_2 per 100 Gms. Water.	Mols. CdI_2 per 100 Mols. H_2O.
0	44.4	79.8	3.9	30	47.3	89.7	4.43
10	45.4	83.2	4.1	40	48.4	93.8	4.6
15	45.8	84.5	4.17	50	49.35	97.4	4.8
18	46.02	85.2	4.2	75	52.65	111.2	5.4
20	46.3	86.2	4.26	100	56.08	127.6	6.3
25	46.8	87.9	4.34				

Density of saturated solution at 18° = 1.590.

Solubility of Cadmium Iodide in Organic Solvents.

Solvent.	t°.	Gms. CdI_2 per 100 Gms. Solution.	Gms. CdI_2 per 100 Gms. Solvent.	Observer.
Absolute Alcohol	15	50.5	102	(Eder.)
Ethyl Alcohol	20	42.6	74.27	(Timofeiew, 1891.)
Methyl Alcohol	20	59.0	143.7	(Timofeiew, 1891.)
Propyl Alcohol	20	28.9	40.67	(Timofeiew, 1891.)
Absolute Acetone	18	20	25 *	(Naumann, 1904.)
Benzonitrile	18	...	1.63	(Naumann, 1914.)
Ethyl Acetate	18	...	1.84 †	(Naumann, 1910.)
Ethyl Ether	12°	...	0.143	(Tyrer, 1911.)
Anhy. Hydrazine	15–20	...	84 ‡	(Welsh and Broderson, 1915.)
Benzene	16.0		0.047	(Linebarger, 1895.)
"	35.0		0.094	"

* d_{18} = .994. † d_{18} = .9145. ‡ per 100 cc.

SOLUBILITY OF CADMIUM IODIDE IN METHYL ALCOHOL, ETHYL ALCOHOL, PROPYL ALCOHOL AND IN ISOPROPYL ALCOHOL AT DIFFERENT TEMPERATURES.

(Muchin, 1913, see also Timofeiew, 1894.)

t°.	Grams CdI_2 per 100 Grams Sat. Solution in:			
	CH_3OH.	C_2H_5OH.	C_3H_7OH.	C_3H_7OH(iso).
0	67	33.5	16	36.9
5	...	41	22	36.9
10	68	54 (at 12.6° = tr. temp.)	28.5	37.2
20	69	53	41.5 (tr. temp.)	37.3
25	69.5	52.2	37.8	37.3
30	70	51.5	35.5	37.3
40	71	50.8	34.5	37.3
50	72.5	50	34.0	37.3

SOLUBILITY OF CADMIUM IODIDE IN ETHYL ETHER. (Linebarger, 1895.)

t°.	Mols CdI_2 per 100 Mols. $CdI_2+(C_2H_5)_2O$.	Gms CdI_2 per 100 gms. $(C_2H_5)_2O$.
0	0.03	0.148
15.5	0.04	0.198
20.3	0.05	0.247

SOLUBILITY OF CADMIUM IODIDE IN METHYL FORMATE, ETHYL FORMATE, PROPYL FORMATE AND IN ETHYL ACETATE AT DIFFERENT TEMPERATURES. (Muchin, 1913.)

t°.	Gms CdI_2 per 100 Gms. Sat. Solution in:			
	$HCOOCH_3$.	$HCOOC_2H_5$.	$HCOOC_3H_7$.	$CH_3COOC_2H_5$.
0	0.84	1.16	2.37	4.73(?)
13.0	0.75	1.05	2.07	1.67
26.0	0.66	0.77	1.53	2.02

SOLUBILITY OF CADMIUM IODIDE IN ANILINE, PYRIDINE AND IN QUINOLINE AT DIFFERENT TEMPERATURES. (Muchin, 1913.)

t°.	Gms. CdI_2 per 100 Gms. Sat. Solution in:		
	$C_6H_5NH_2$.	C_5H_5N.	C_9H_7N.
40	1.7	...	...
50	2.3	0.1	...
60	3.1	0.5	2
70	4	1.7	3.5
80	5.1	4.8	5
90	6.4	13.4	6.7
100	8.4	30	8.3

SOLUBILITY OF CADMIUM IODIDE IN MIXTURES OF SOLVENTS AT DIFFERENT TEMPERATURES. (Muchin, 1913.)

Composition of Solvent in Mols.	Wt. per cent Alcohol in Solvent.	Gms. CdI_2 per 100 Gms. Sat. Solution at:		
		0°.	16.8°.	36.8°.
$1CH_3OH+2CHCl_3$	11.8	11.0	10.4	9.3
$1CH_3OH+1CHCl_3$	21.1	22.4	22.3	20.6
$1C_2H_5OH+2CHCl_3$	16.2	7.5	7.1	6.6
$1C_2H_5OH+1CHCl_3$	27.8	13.9	14.3	13.6
$2C_2H_5OH+1CHCl_3$	43.5	25.2	24.1	...
$xC_2H_5OH+yCHCl_3$	60.3	34.4	...	...
" "	91.5	45.4	...	...
$1C_2H_5OH+2C_6H_6$	22.8	17.6	16.3 (16.3°)	15.2 (31.2°)
$1C_2H_5OH+1C_6H_6$	37.1	26.1	26.0 (15.7°)	26.0 "
$2C_2H_5OH+1C_6H_6$	54.1	33.5	35.3 (15°)	...
$xC_2H_5OH+yC_6H_6$	9.8	6.5	...	...

Solubility of Cadmium Iodide in Mixtures of Solvents.

(Muchin, 1913.)

Results for a mixed solvent composed of:

One Mol. Pyridine+One Mol. Chloroform.				One Mol. Pyridine+One Mol. Benzene.			
t°.	Gms. CdI_2 per 100 Gms. Sat. Sol.	t°.	Gms. CdI_2 per 100 Gms. Sat. Sol.	t°.	Gms. CdI_2 per 100 Gms. Sat. Sol.	t°.	Gms CdI_2 per 100 Gms. Sat. Sol.
50.1	1.27	63	6.3	57.9	1.77	72.5	32.6
54	1.72	64	8.3	60	2.2	74.0	35.9
56	2.3	64.5	12.35	65	4.2	76	36.3
58	3.0	64	14.8	70	8.1	80	40.8
60	4.0	62	22.0	71	11.5	85	41.6
62	5.6	61.15	24.67	71.5	15.0	90.4	42.67

Solubility of Cadmium Iodide in Ethyl Ether Containing Water at 12°.

(Tyrer, 1911)

Gms. H_2O per 100 gms. ether+H_2O→	0.0	0.10	0.30	0.50	0.70	0.90	1.00	1.10	1.14 sat.
Gms. CdI_2 per 100 gms. solvent→	0.143	0.78	2.07	3.36	4.77	6.46	7.30	8.27	8.68

Distribution of Cadmium Iodide at 30° Between:

(Dahr and Datter, 1913.)

Water and Amyl Alcohol.			Water and Ethyl Ether.		
Gms. per 100 cc			Gms per 100 cc		
H_2O Layer (c).	Alcohol Layer (c').	$\frac{c}{c'}$.	H_2O Layer (c).	Ether Layer (c').	$\frac{c}{c'}$.
47.75	43	1.11	37.18	8.38	4.43
29.08	25.86	1.13	30.03	6.61	4.54
14.46	12.55	1.15	15.38	3.09	4.97
10.69	8.94	1.20	12.60	2.38	5.29
6.23	4.94	1.33	9.89	1.83	5.40
2.42	1.54	1.55	7.68	1.06	5.52
1.93	1.10	1.76	4.03	0.73	5.60
1.76	0.94	1.87	3.10	0.51	6.03

Freezing-point data (solubility, see footnote, p. 1) are given for the following mixtures:

Cadmium Iodide + Cuprous Iodide (Herrmann, 1911.)
" " + Mercuric Iodide (Sandonnini, 1914.)
" " + Potassium Iodide (Brand, 1912.)
" " + Sodium Iodide "

CADMIUM AMMONIUM IODIDES (Mono and Di).

Solubility of Each Separately in Water, etc.

(Rimbach, 1905; Eder, 1876)

	Cd. Mono Ammonium Iodide.			Cd. Diammonium Iodide.		
Solvent.	t°.	Gms. $CdI_2.NH_4I$ per 100 Gms. Solution.	Solvent.	t°.	Gms. $CdI_2.2NH_4I$ per 100 Gms. Solution.	Solvent.
Water	15	52.6	111	14.5	85.97	611.6
Abs. Alcohol	15	53	113	15	59	143
Abs. Ether	15	29.4	41.7	15	10	11

CADMIUM POTASSIUM IODIDES, Mono = $CdI_2.KI.H_2O$, Di = $CdI_2.2KI.2H_2O$.

CADMIUM DiSODIUM IODIDE $CdI_2.2NaI.6H_2O$.

SOLUBILITY OF EACH SEPARATELY IN WATER, ETC., AT 15°.

(Eder.)

Solvent.	Gms. CdI_2 KI per 100 Gms. Solution.	Solvent.	Gms. CdI_2 2KI per 100 Gms. Solution.	Solvent.	Gms. $CdI_2.2NaI$ per 100 Gms. Solution.	Solvent.
Water	51.5	106	57.8	137	61.3	158.8
Abs. Alcohol	...	...	41.7	71	53.7	116.2
Abs. Ether	...	...	3.9	4.1	9.0	9.9

CADMIUM NITRATE $Cd(NO_3)_2$.

SOLUBILITY IN WATER.

(Funk — Wiss. Abh. p. t. Reichanstalt 3 440, '00.)

t°.	Gms. $Cd(NO_3)_2$ per 100 Gms. Solution.	Water.	Mols. $Cd(NO_3)_2$ per 100 Mols. H_2O.	Solid Phase.
−13	37 37	59.67	4.55	$Cd(NO_3)_2.9H_2O$
− 1	47.33	89.86	6 85	"
+ 1	52.73	111.5	8.50	"
0	52.37	109.7	8.37	$Cd(NO_3)_2.4H_2O$
+18	55.9	126.8	9 61	"
30	58.4	140.4	10.7	"
40	61.42	159.2	12.1	"
59.5	76.54	326.3	25.0	"

Density of saturated solution at 18° = 1.776.

The eutectic of the system $Cd(NO_3)_2.4H_2O + Cd(NO_3)_2$ is at 44.8° and has the composition $Cd(NO_3)_2.2.65H_2O$. (Vasilev, 1910.)

CADMIUM OXALATE $CdC_2O_4.3H_2O$.

1 liter of sat. aqueous solution contains 0.033 gm. CdC_2O_4 at 18°. (Kohlrausch, 1908.)

CADMIUM SILICATE $CdSiO_3$.

Fusion-point data are given for $CdSiO_3 + ZnSiO_3$. (van Klooster, 1910–11.)

CADMIUM SULPHATE $CdSO_4$.

SOLUBILITY IN WATER.

(Mylius and Funk — W. Abh p. t. Reichanstalt 3, 444, '00; see also Kohnstamm and Cohn — Wied Ann. 65, 344, '98, Steinwehr — Ann. der Phys. (Drude) [4] 9, 1050, '02; Etard — Ann. chim. phys [7] 2 536, '94.)

t°.	Gms. $CdSO_4$ per 100 Gms. Solution.	Water.	Solid Phase.	t°.	Gms. $CdSO_4$ per 100 Gms. Solution.	Water.	Solid Phase.
−17	44.5	80.2	$CdSO_4.7H_2O$	40	43.99	78.54	$CdSO_4.\frac{8}{3}H_2O$.
−10	46.1	85.5	"	60	44.99	83.68	"
− 5	48.5	94.2	"	73.5	46.6	87.28	"
−18	43.35	76.52	$CdSO_4.\frac{8}{3}H_2O$	74.5	46.7	87.62	$CdSO_4.H_2O$
−10	43.27	76.28	"	77	42.2	73.02	"
0	43.01	76.48	"	85	39.6	65.57	"
+10	43.18	76.00	"	90	38.7	63.13	"
20	43.37	76.60	"	100	37.8	60.77	"

For results at high pressures, see Cohen (1909).

SOLUBILITY OF CADMIUM SULPHATE IN AQUEOUS SOLUTIONS OF SULPHURIC ACID AT 0°.

(Engel — Compt. rend. 104, 507, '87.)

Equivalents per 10 Gms. H_2O.		Density of Solutions.	Grams per 100 Grams H_2O.	
H_2SO_4.	$CdSO_4$.		H_2SO_4.	$CdSO_4$.
0.	71.6	1.609	0.00	74.61
3.87	70.9	1.591	1.90	73.87
12.6	62.4	1.545	6.18	65.03
28.1	50.6	1.476	13.78	52.73
43.3	40.8	1.435	21.23	42.52
47.6	37.0	1.421	23.34	38.56
53.8	32.7	1.407	26.38	34 07
71.5	23.0	1.379	35.06	23.96

100 gms. 95% formic acid dissolve 0.06 gm. $CdSO_4$ at 18.5°. (Aschan, 1913)
Freezing-point data (solubility, see footnote, p. 1) are given for mixtures of $CdSO_4 + Li_2SO_4$, $CdSO_4 + K_2SO_4$ and $CdSO_4 + Na_2SO_4$ by Calcagni and Marotta (1913).

SOLUBILITY OF MIXED CRYSTALS OF CADMIUM SULPHATE AND FERROUS SULPHATE IN WATER AT 25°.

(Stortenbecker — Z. physik Chem. 34, 109, '00.)

Composition of Solution.					Mol. per cent Cd in Crystals of Solid Phase.
Gms. per 100 Gms H_2O.		Mols per 100 Mols. H_2O.		Mol % Cd. in Sol.	
$CdSO_4$.	$FeSO_4$.	Cd.	Fe.		
Crystals with $2\frac{2}{3}$ Mols. H_2O.					
76.02	0.0	6.57	0.0	100	100
57.61	10.63	4.98	1.26	79.8	99.0
Crystals with 7 Mols. H_2O.					
57.61	10.63	4.98	1.26	79.8	36.6
...	...	...	...	78.5	34.6
...	...	...	...	44.6	11.1
...	...	...	...	24 4	4 8
0.0	26.69	0.0	3.165	0.0	0.0

CADMIUM POTASSIUM SULFATE $CdK_2(SO_4)_2$.

SOLUBILITY IN WATER.

(Wyrouboff, 1901.)

t°.	G. $CdK_2(SO_4)_2$ per 100 Gms. H_2O.	Solid Phase.	t°.	G. $CdK_2(SO_4)_2$ per 100 Gms H_2O	Solid Phase.
16	42.89	$CdK_2(SO_4)_2.2H_2O$	26	42.50	$CdK_2(SO_4)_2.1\frac{1}{2}H_2O$
31	46.82	"	31	42.80	"
40	47.40	"	40	43.45	"
			64	44.90	"

CADMIUM SODIUM SULFATE $CdNa_2(SO_4)_2.2H_2O$.

SOLUBILITY IN WATER, ALSO WITH THE ADDITION OF CADMIUM SULPHATE AND OF SODIUM SULPHATE.

(Koppel, Gumpery — Z. physik. Chem. 52, 413, '05)

t°.	Gms. per 100 Gms. Solution.		Gms. per 100 Gms. H_2O.		Mols. per 100 Mols. H_2O.		Solid Phase.
	$CdSO_4$.	Na_2SO_4.	$CdSO_4$.	Na_2SO_4.	$CdSO_4$.	Na_2SO_4.	
24	22.25	15.07	35.49	24.04	3.07	3.05	$CdNa_2(SO_4)_2.2H_2O$
30	22.55	15.29	36.28	24.60	3.14	3.12	"
40	22.89	15.65	37.24	25.45	3.22	3.28	"
0	40.32	4.85	73.54	8.85	6.36	1.12	$CdNa_2(SO_4)_2.2H_2O + CdSO_4.\frac{8}{3}H_2O$
10	39.91	5.24	72.77	9.55	6.30	1.21	"
20	40.26	5.16	73.81	9.45	6.39	1.20	"
40	39.89	7.18	75.38	13.56	6.52	1.72	"
−14.8	40.18	4.60	72.68	8.32	6.29	1.05	$CdNa_2(SO_4)_2.2H_2O + Na_2SO_4.10H_2O$
0	37.30	6.53	66.32	11.62	5.74	1.47	"
10	32.53	8.69	55.34	14.78	4.79	1.84	"
20	22.69	14.71	36.25	23.52	3.14	2.98	"
25	16.33	19.82	25.60	31.06	2.21	3.94	"
30	9.21	27.80	14.62	44.14	1.26	4.59	$CdNa_2(SO_4)_2.2H_2O + Na_2SO_4$
35	8.26	29.35	13.26	47.06	1.15	5.96	"
40	9.98	28.27	16.24	46.27	1.41	5.86	"

CADMIUM SULFIDE CdS.

1000 cc. H_2O dissolves 9×10^{-6} gms. CdS at 18°. (Weigel, 1906.)

CAESIUM ALUMS

SOLUBILITY OF CAESIUM CHROMIUM ALUM, CAESIUM IRON ALUM, CAESIUM INDIUM ALUM, AND OF CAESIUM VANADIUM ALUM IN WATER.

(Locke — Am. Ch. J. 27, 174, '01.)

Formula of Alum.	t°.	Gms. per 100 cc. H_2O. Anhydrous Salt.	Hydrated Salt.	Gram Mols. Salt per 100 cc. H_2O.
$Cs_2Cr_2(SO_4)_4.24H_2O$	25	0.57	0.94	0.00151
"	30	0.96	1.52	0.0025
"	35	1.206	1.91	0.0032
"	40	1.53	2.43	0.00405
$Cs_2Fe_2(SO_4)_4.24H_2O$	25	1.71	2.72	0.0045
"	30	2.52	4.01	0.0066
"	35	3.75	6.01	0.0099
"	40	6.04	9.80	0.0156
$Cs_2In_2(SO_4)_4.24H_2O$	25	7.57	11.73	0.0172
$Cs_2V_2(SO_4)_2.24H_2O$	25	0.771	1.31	0.00204

See also Alums, p. 32.

CAESIUM CHLORAURATE $CsAuCl_4$.

SOLUBILITY IN WATER.
(Rosenbladt, 1886.)

t°.	Gms. $CsAuCl_4$ per 100 Gms. Solution.	t°.	Gms. $CsAuCl_4$ per 100 Gms. Solution.	t°.	Gms. $CsAuCl_4$ per 100 Gms. Solution.
10	0.5	40	3.2	80	16.3
20	0.8	50	5.4	90	21.7
30	1.7	60	8.2	100	27.5
		70	12.0		

CAESIUM FLUOBORIDE $CsBFl_4$.

100 grams water dissolve 0.92 gram $CsBFl_4$ at 20°, and 0.04 gram at 100°.
(Godeffroy, 1876.)

CAESIUM BROMIDE CsBr.

SOLUBILITY OF CAESIUM AND LEAD BROMIDES AND THEIR DOUBLE SALTS IN WATER AT 25°.
(Foote, 1907.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
CsBr.	$PbBr_2$.		CsBr	$PbBr_2$.	
0.24	0.33	$PbBr_2+CsPb_2Br_5$	33.65	trace	$CsPbBr_3$
0.33	0.36	" "	36.7	"	" $+Cs_4PbBr_6$
12.83	trace	$CsPb_2Br_5$	46.4	"	Cs_4PbBr_6
17.24	"	"	51.15	"	"
17.68	"	" $+CsPbBr_3$	54.4	"	" $+CsBr$
18.58	"	$CsPbBr_3$	55.23	0	CsBr

CAESIUM Mercuric **BROMIDE** $CsBr.2HgBr_2$.

100 grams saturated aqueous solution contain 0.807 gram $CsBr.2HgBr_2$ at 16°.
(Wells, 1892.)

CAESIUM CARBONATE Cs_2CO_3.

100 grams absolute alcohol dissolve 11.1 grams Cs_2CO_3 at 19°, and 20.1 grams at b. pt.
(Bunsen.)

CAESIUM Bi**CARBONATE** $CsHCO_3$.

100 grams sat. solution in H_2O contain 67.8 grams $CsHCO_3$ at about 20°.
(de Forcraud, 1909.)

CAESIUM CHLORATE $CsClO_3$ **CAESIUM** Per**CHLORATE** $CsClO_4$.

SOLUBILITY OF EACH IN WATER.
(Calzolari, 1912; see also Carlson, 1910)

Results for $CsClO_3$.				Results for $CsClO_4$.			
t°.	Gms. $CsClO_3$ per 100 Gms. H_2O.	t°.	Gms. $CsClO_3$ per 100 Gms. H_2O.	t°.	Gms. $CsClO_4$ per 100 Gms. H_2O.	t°.	Gms. $CsClO_4$ per 100 Gms. H_2O.
0	2.46	50	19.4	0	0.8	50	5.4
10	3.8	60	26.2	10	1.0	60	7.3
20	6.2	70	34.7	20	1.6	70	9.8
25	7.6	80	45.0	25	2.0 (d=1.01)	80	14.4 (d=1.084)
30	9.5	90	58.0	30	2.6	90	20.5
40	13.8	100	79.0	40	4.0	100	30.0

CAESIUM CHLORIDE CsCl.

SOLUBILITY IN WATER.

(Berkeley — Trans. Roy. Soc. (Lond.) 203 A, 208, '04; see also Hinrichsen and Sachsel — Z. physik. Chem. 50, 99, '04–'05; at 25°, Foote.)

t°.	G. CsCl per 100 Gms. Solution.	G. CsCl per 100 Gms. Water.	G. Mol. CsCl per Liter.	t°.	G. CsCl per 100 Gms. Solution.	G. CsCl per 100 Gms. Water.	G. Mol. CsCl per Liter.
0	61.7	161.4	6.74	60	69.7	229.7	8.28
10	63.6	174.7	7.11	70	70.6	239.5	8.46
20	65.1	186.5	7.38	80	71.4	250.0	8.64
30	66.4	197.3	7.63	90	72.2	260.1	8.80
40	67.5	208.0	7.86	100	73.0	270.5	8.96
50	68.6	218.5	8.07	119.4	74.4	290.0	9.22

SOLUBILITY OF MIXTURES OF CAESIUM CHLORIDE AND MERCURIC CHLORIDE IN WATER AT 25°. (Foote, 1903.)

Gms. per 100 Gms. Solution CsCl.	HgCl₂.	Solid Phase.	Gms. per 100 Gms. Solution. CsCl.	HgCl₂.	Solid Phase.
65.61	0.0	CsCl	38.63	1.32	Double Salt $CsHgCl_3$ = 38.3% CsCl
65.78	0.215	CsCl + Cs_3HgCl_5	17.03	0.51	"
62.36	0.32	Double Salt Cs_3HgCl_5 = 65.1% CsCl	1.53	0.42	"
57.01	0.64	"	0.61	2.64	CsHg + $CsHg_2Cl_5$
52.35	1.23	"	0.49	2.91	Double Salt $CsHg_2Cl_5$ = 23.7% CsCl
51.08	1.44	Cs_3HgCl_5 + Cs_2HgCl_4	0.40	3.78	"
49.30	1.49	Double Salt Cs_2HgCl_4 = 55.4% CsCl	0.44	4.63	$CsHg_2Cl_5$ + $CsHg_5Cl_{11}$
45.95	1.69	"	0.41	4.68	Double Salt $CsHg_5Cl_{11}$ = 11.1% CsCl
45.23	1.73	Cs_2HgCl_4 + $CsHgCl_3$	0.25	5.65	"
			0.18	7.09	$CsHg_5Cl_{11}$ + $HgCl_2$
			0.0	6.90	$HgCl_2$

SOLUBILITY OF MIXTURES OF CAESIUM CHLORIDE AND MERCURIC CHLORIDE IN ACETONE AT 25°. (Foote, 1911)

Gms. per 100 Gms. Solution. CsCl.	HgCl₂.	Solid Phase.	Gms. per 100 Gms. Solution. CsCl	HgCl₂.	Solid Phase.
0.032	0	CsCl	0.48	28.48	$CsCl.2HgCl_2$
0.11	0.02	Mixed salts	0.48	39.65	"
0.19	0.16	"	0.47	44.40	" + $CsCl.5HgCl_2$
0.25	0.17	"	0.32	49.83	$CsCl.5HgCl_2$
0.45	13.08	$CsCl.HgCl_2$	0.20	57.74	"
0.46	21.50	"	0.13	57.76	" + $HgCl_2$
0.56	27.2	" + $CsCl.2HgCl_2$	0.0	57.74	$HgCl_2$

CAESIUM Iridium CHLORIDES Cs_2IrCl_6, etc.

100 gms. H_2O dissolve 0.011 gm. caesium chloroiridate, Cs_2IrCl_6 at 19°. (Delepine, 1908.)
100 " " " 0.05 gm. caesium hexachloroiridite, $Cs_3IrCl_6.3H_2O$ at 19°.
100 " " " 0.83 " caesium aquopentachloroiridite, $Cs_2H_2OIrCl_5$ at 19°.

CAESIUM Platinic CHLORIDE $CsPtCl_6$.

100 gms. H_2O dissolve 0.135 gm. $CsPtCl_6$ at 20°. (Rosenheim and Weinhebe., 1910–11.)

CAESIUM Tellurium CHLORIDE $CsTeCl_6$.

SOLUBILITY IN AQUEOUS HYDROCHLORIC ACID. (Wheeler, 1893.)

100 parts HCl (Sp. Gr. 1.2) dissolve 0.05 part $CsTeCl_6$ at 22°.
100 parts HCl (Sp. Gr. 1.05) dissolve 0.78 part $CsTeCl_6$ at 22°.

CAESIUM Thallium CHLORIDE $3CsCl.TlCl_3.2H_2O$.

100 parts H_2O dissolve 2.76 parts $3CsCl.TlCl_3.2H_2O$ at 17°, and 33.3 parts at 100°. (Godeffroy, 1886.)

Freezing-point lowering data (solubilities, see footnote, p. 1) are given for the following mixtures of caesium chloride and other salts.

Mixture.	Authority.
Caesium Chloride + Cuprous Chloride	(Sandonnini and Scarpa, 1912; Sandonnini, 1914.)
" " + Silver Chloride	" " "
" " + Thallium Chloride	" " "
" " + Lithium Chloride	(Korreng, 1915; Richards and Meldrum, 1917.)
" " + " " +NaCl	(Richards and Meldrum, 1917.)
" " + Potassium Chloride	(Zemczuzny and Rambach, 1910.)
" " + Rubidium "	" " "
" " + Sodium "	" " "

CAESIUM CHROMATES, Cs_2CrO_4, $Cs_2Cr_2O_7$, etc.

SOLUBILITY IN WATER AT 30°.
(Schreinemakers and Meijeringh, 1908.)

Gms. per 100 Gms. Sat. Sol. Cs_2O.	CrO_3.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. Cs_2O	CrO_3	Solid Phase.
70.63	0.0	$CsOH.nH_2O$	0.169	21.21	$Cs_2Cr_3O_{10}$
69.22	0.119	" $+Cs_2CrO_4$	0.096	25.59	"
36.06	1.883	Cs_2CrO_4	1.89	36.19	"
31.00	7.523	"	2.79	41.68	"
31.68	9.652	"	3.29	44.23	"
35.80	13.08	"	±3.13	±44.45	" $+Cs_2Cr_4O_{13}$
31.05	10.79	$Cs_2Cr_2O_7$	2.96	44.66	$Cs_2Cr_4O_{13}$
24.05	8.98	"	3.40	46.03	"
3.04	2.16	"	3.94	56.77	"
1.61	4.57	"$+Cs_2Cr_3O_{10}$	4.35	62.70	" $+CrO_3$
1.18	7.95	$Cs_2Cr_3O_{10}$	2.33	62.50	CrO_3
0.586	15.05	"	0	62.28	"

CAESIUM FLUORIDE $CsF.1\frac{1}{2}H_2O$.

100 gms. H_2O dissolve 366.5 gms. CsF at 18°, solid phase $CsF.1\frac{1}{2}H_2O$.
(de Forcrand, 1911.)

CAESIUM HYDROXIDE CsOH.

100 gms. sat. solution in H_2O contain 79.41 gms. CsOH at 15° (de Forcrand, 1909a); for 30°, see above.

CAESIUM IODATE $CsIO_4$.

100 parts H_2O dissolve 2.6 parts $CsIO_3$ at 24°, and 2.5 parts $2CsIO_3.I_2O_5$ at 21°. (Wheeler, 1892; Barker, 1908.)

CAESIUM Per IODATE $CsIO_4$.

100 gms. H_2O dissolve 2.15 gms. $CsIO_4$ at 15°, d_{15} sat. solution = 1.0166. (Barker, 1908.)

CAESIUM IODIDES CsI, CsI_3, etc.

SOLUBILITY IN WATER AT 25°.
(Foote and Chalker, 1908.)

Gms. per 100 Gms. Sat. Solution. CsI.	I.	Empirical Comp. of Residue	Present in Residue.
7.72	1.18	$CsI_{3.29}$	CsI_3 and CsI_5
7.69	1.19	$CsI_{3.98}$	" "
2.40	1.23	$CsI_{5.75}$	CsI_5 and I
2.35	1.23	$CsI_{7.43}$	" "
2.39	1.25	$CsI_{19.3}$	" "

CAESIUM IODIDE CsI.

SOLUBILITY OF MIXTURES OF CAESIUM IODIDE AND IODINE IN WATER.

(Foote — Am. Ch. J. 29, 210, '03.)

t°.	Gms. per 100 Gms. Solution. CsI.	I.	t°.	Gms. per 100 Gms. Solution. CsI.	I.	Solid Phase at both Temps.
−4	27.68	0.0	35.6	51.48	0.0	CsI
−4	27.52	0.09	35.6	51.66	0.71	CsI and CsI_3
−4	3.18	0.31	35.6	10.72	1.78	CsI_3 and CsI_5
−0.2	0.85	0.34	35.6	3.74	1.60	CsI_5 and I

t°.	Gms. per 100 Gms. Solution. CsI.	I.	In Separated Heavy Solution Gms. per 100 Gms. Solution. CsI.	I.	Solid Phase.
52.2	16.75	4.52	...	...	CsI_3 and CsI_5
52.2	6.69	3.36	...	...	CsI_5 and I
52.2	6.72	3.32	22.94	73.72	CsI_5
52.2	6.65	3.45	22.80	74.63	I
73	26.98	15.07	...	...	CsI_3 and CsI_5
73	16.66	10.50	27.56	68.40	CsI_5
73	6.27	4.08	17.68	80.02	I

CAESIUM (Tri) IODIDE CsI_3.

100 cc. saturated aqueous caesium iodide (about 17 per cent CsI) solution contain 0.97 gram CsI_3 at 20°, density of solution = 1.154.

(Wells — Am. J. Sci. [3] 44, 221, '92.)

CAESIUM NITRATE $CsNO_3$.

SOLUBILITY IN WATER.

(Berkeley — Trans. Roy. Soc. (Lond.) 203 A, 213, '04.)

t°.	Gms. $CsNO_3$ per 100 Gms. Solution.	Water.	G. Mols. $CsNO_3$ per Liter.	t°.	Gms. $CsNO_3$ per 100 Gms. Solution.	Water.	G. Mols $CsNO_3$ per Liter.
0	8.54	9.33	0.476	60	45.6	83.8	3.41
10	12.97	14.9	0.725	70	51.7	107.0	4.10
20	18.7	23.0	1.11	80	57.3	134.0	4.81
30	25.3	33.9	1.58	90	62.0	163.0	5.50
40	32.1	47 2	2.12	100	66.3	197.0	6.19
50	39.2	64.4	2.73	106.2	68.8	220.3	6.58

THE ICE CURVES FOR MIXTURES OF CAESIUM NITRATE AND WATER, DETERMINED BY THE SYNTHETIC METHOD.

(Jones, 1908.)

Solubility curve. t° of Crystallization.	Gms. $CsNO_3$ per 100 Gms. H_2O.	Solid Phase.	Supersolubility curve. t° of Crystallization.	Gms. $CsNO_3$ per 100 Gms. H_2O.	Solid Phase.
−0.3	0.21	Ice	−1.2	0.21	Ice
−0.4	1.28	"	−2.5	1.28	"
−1.2	6.01	"	−3.0	3.99	"
−1.3	8.0	"	−3.2	6.01	"
−1.4 (Eutec.)	...	"	−3.2	8	"

The eutectic is given as −1.254° and 8.51 gms. $CsNO_3$ per 100 gms. H_2O, by Washburn and MacInnes (1911).

CAESIUM OXALATE $Cs_2C_2O_4.H_2O$.

SOLUBILITY OF MIXTURES OF CAESIUM OXALATE AND OXALIC ACID IN WATER AT 25°.

(Foote and Andrew, 1905.)

Varying amounts of the two substances were dissolved in hot water and the solutions allowed to cool in a thermostat held at 25°.

Gms. per 100 Gms. Solution.		G. Mols. per 100 G. Mols. H_2O.		Solid Phase.
$H_2C_2O_4$.	$Cs_2C_2O_4$.	$H_2C_2O_4$.	$Cs_2C_2O_4$.	
10.20	...	2.274	...	$H_2C_2O_4.2H_2O$
10.29	0.61	2.314	0.035	$H_2C_2O_4.2H_2O+H_3Cs(C_2O_4)_2.2H_2O$
7.90	9.92	1.924	0.614	Double Salt.
4.11	25.12	1.162	1.81	$H_3Cs(C_2O_4)_2.2H_2O$
4.32	27.55	1.279	2.06	$H_3Cs(C_2O_4)_2 2H_2O+H_4Cs_2(C_2O_4)_3$
4.27	28.30	1.267	2.14	Double Salt.
4.40	35.90	1.476	3.07	$H_4Cs_2(C_2O_4)_3$
4.82	40.10	1.752	3.71	$H_4Cs_2(C_2O_4)_3+HCsC_2O_4$
4.45	42.32	1.672	4.05	Double Salt.
3.05	48.80	1.268	5.16	$HCsC_2O_4$
1.04	68.69	0.688	11.56	
0.91	71.24	0.648	13.06	$HCsC_2O_4+H_6Cs_8(C_2O_4)_7$
0.77	73.45	0.598	14.51	Double Salt.
0.75	74.04	0.596	14.96	$H_6Cs_8(C_2O_4)_7$
0.74	75.20	0.625	15.93	$H_6Cs_8(C_2O_4)_7+Cs_2C_2O_4.H_2O$
0.0	75.82	0.0	15.97	$Cs_2C_2O_4.H_2O$

CAESIUM Telluracid **OXALATE** $Cs_2[H_6TeO_6.C_2O_4]$.

100 gms. H_2O dissolve 6.42 gms. $Cs_2[H_6TeO_6.C_2O_4]$ at 0°, 12.39 gms. at 20°, 15.08 gms. at 30°, 19.78 gms. at 40° and 27.66 gms. at 50°.

(Rosenheim and Weinheber, 1910-11.)

CAESIUM PERMANGANATE $CsMnO_4$.

100 cc. sat. aqueous solution contain 0.097 gm. $CsMnO_4$ at 1°, 0.23 gm. at 19°, and 1.25 gms. at 59°. (Patterson — J. Am. Chem. Soc. 28, 1735, '06.)

CAESIUM SELENATE Cs_2SeO_4.

100 grams H_2O dissolve 245 grams Cs_2SeO_4 at 12°.

(Tutton — J. Chem. Soc. 71, 850, '97.)

CAESIUM SULPHATE Cs_2SO_4.

SOLUBILITY IN WATER.

(Berkeley — Trans. Roy. Soc. (Lond.) 203 A, 210, '04.)

t°.	Gms. Cs_2SO_4 per 100 Gms Solution.	Gms. Cs_2SO_4 per 100 Gms Water.	G. Mols. Cs_2SO_4 per Liter.	t°.	Gms. Cs_2SO_4 per 100 Gms. Solution.	Gms. Cs_2SO_4 per 100 Gms. Water.	G. Mols. Cs_2SO_4 per Liter.
0	62.6	167.1	3.42	60	66.7	199.9	3.78
10	63.4	173.1	3.49	70	67.2	205.0	3.83
20	64.1	178.7	3.56	80	67.8	210.3	3.88
30	64.8	184.1	3.62	90	68.3	214.9	3.92
40	65.5	189.9	3.68	100	68.8	220.3	3.97
50	66.1	194.9	3.73	108.6	69.2	224.5	4.00

SOLUBILITY OF CAESIUM DOUBLE SULPHATES IN WATER AT 25°.

(Locke — Am. Ch. J. 27, 459, '01.)

Name.	Formula.	Gms. Anhydrous Salt per 100 Gms. Solution.	Gms. Anhydrous Salt per 100 Gms. Water.	Gm. Mols. Salt per 100 Gms. H_2O.
Caesium Cadmium Sulphate	$Cs_2Cd(SO_4)_2.6H_2O$	58.16	139.9	0.2455
Caesium Cobalt Sulphate	$Cs_2Co(SO_4)_2.6H_2O$	29.52	41.9	0.081
Caesium Copper Sulphate	$Cs_2Cu(SO_4)_2.6H_2O$	31.49	46.0	0.0882
Caesium Iron Sulphate	$Cs_2Fe(SO_4)_2.6H_2O$	50.29	101.1	0.1967
Caesium Magnesium Sulphate	$Cs_2Mg(SO_4)_2.6H_2O$	34.77	53.3	0.1106
Caesium Manganese Sulphate	$Cs_2Mn(SO_4)_2.6H_2O$	44.58	80.4	0.157
Caesium Nickel Sulphate	$Cs_2Ni(SO_4)_2.6H_2O$	20.37	25.6	0.0495
Caesium Zinc Sulphate	$Cs_2Zn(SO_4)_2.6H_2O$	27.87	38.6	0.0738

SOLUBILITY OF CAESIUM SODIUM SULFATES IN WATER AT 25°.

(Foote, 1911.)

Gms. per 100 Gms. Sat. Solution. Cs_2SO_4.	Gms. per 100 Gms. Sat. Solution. Na_2SO_4.	Per cent $CsSO_4$ in Residue.	Empirical Composition of Residue.
54.65	11.44	89.98	$1Na_2SO_4.3.53Cs_2SO_4$
54.58	11.63	78.22	$1Na_2SO_4.1.41Cs_2SO_4$
54.81	11.25	34.67	$4.8Na_2SO_4.1Cs_2SO_4$

The author's solubility method for determination of the formation and composition of double salts is described in the paper containing the above results.

CAESIUM Dihydroxy**TARTRATE** $Cs_2C_4H_4O_8.2H_2O$.

100 gms. H_2O dissolve 22.5 gms. $Cs_2C_4H_4O_8.2H_2O$ at 0°. (Fenton, 1898.)

CAFFEINE $C_5H(CH_3)_3N_4O_2.H_2O$.

SOLUBILITY IN WATER.

(Average curve from results of Zalai, 1910; Pellini, 1910, and U.S.P., 8th Ed.)

t°.	Gms. $C_5H(CH_3)_3N_4O_2$ per 100 Gms. H_2O.	t°.	Gms. $C_5H(CH_3)_3N_4O_2$ per 100 Gms. H_2O.
0	0.6	40	4.64
15	1.0	50	6.75
20	1.46	60	9.7
25	2.13	70	13.5
30	2.8	80	19.23

SOLUBILITY OF CAFFEINE IN ORGANIC SOLVENTS.

Solvent.	t°.	Gms. $C_5H(CH_3)_3N_4O_2$ per 100 Gms. Solvent.	Solvent.	t°.	Gms. $C_5H(CH_3)_3N_4O_2$ per 100 Gms. Solvent.
Ethyl Alcohol	25	1.32 (2)	Carbon Tetrachloride	18	0.09 (4)
" "	25	1.88 (1)		20	0.26 (6)
" "	60	5.85 (1)		b.pt.	0.70 (4)
Methyl "	25	1.14 (2)	Chloroform	17	12 9 (5)
Amyl "	25	0.50 (3) (d_{25}=0.810)	"	25	12.3 (1)
Amyl Acetate	30.5	0.72 (3) (d_{30}=0.862)	"	25	11.92 (2)
Acetic Acid (99.5%)	21.5	2.6 (3)	"	b.pt.	15.63 (4)
Acetone	30.5	2 32 (3) (d_{30}=0.832)	Ether	18	0.12 (4)
Aniline	30.5	29.4 (3) (d_{30}=1.080)	"	25	0.27 (1)
Benzaldehyde	30.5	13.1 (3) (d_{30}=1.087)	"	b.pt.	0.30 (4)
Benzene	18 0	0.91 (4)	Trichlorethylene	15	0.76 (7)
"	25.0	1.16 (2)	Dichlorethylene	15	1.82 (7)
"	30.5	1.23 (3) (d_{30}=0.875)	Pyridine	20–25	34.39 (8)
"	b.pt.	5.29 (4)	50% Aq. Pyridine	"	11.12 (8)
Carbon Disulfide	17	0.06 (5)	Toluene	25	0.58 (3) (d_{25}=0.861)
			Xylene	32.5	1.13 (3) (d_{25}=0.847)

(1) = U. S. P.; (2) = Schaefer, 1913; (3) = Seidell, 1907; (4) = Göckel, 1898; (5) = Commaille, 1875; (6) = Gori, 1913; (7) = Wester and Bruins (1914); (8) = Dehn, 1917.

Data for the solubility of caffeine in mixtures of alcohol and chloroform and alcohol and benzene are given by Schaefer (1913).

SOLUBILITY OF CAFFEINE IN AQUEOUS SOLUTIONS OF SODIUM BENZOATE AND VICE VERSA. (Pellini, 1910.)

Results at 25°.

Gms. per 100 Gms H_2O. $C_8H_{10}N_4O_2$.	$C_7H_5O_2Na$.	Solid Phase.
2.13	0	$C_8H_{10}N_4O_2.H_2O$
8.32	6.67	"
38.10	45	"
51.74	76.75	" + $C_7H_5O_2Na.H_2O$
46.27	76.68	$C_7H_5O_2Na.H_2O$
24.79	69.56	"
9.47	62.97	"
0	61.17	"

Results at 40°.

Gms per 100 Gms H_2O. $C_8H_{10}N_4O_2$.	$C_7H_5O_2Na$.	Solid Phase.
4.64	0	$C_8H_{10}N_4O_2.H_2O$
31.43	25.31	"
56.82	69.68	"
57.99	74.64	" + $C_7H_5O_2Na\ H_2O$
55.98	74.02	$C_7H_5O_2Na\ H_2O$
18.31	67.97	"
0	59.82	"

SOLUBILITY OF CAFFEINE IN AQUEOUS SOLUTIONS OF SODIUM SALICYLATE AND VICE VERSA. (Pellini and Amadori, 1912.)

Results at 25°

Gms. per 100 Gms H_2O $C_8H_{10}N_4O_2$.	$C_7H_5O_3Na$.	Solid Phase.
2.13	0	$C_8H_{10}N_4O_2.H_2O$
38.36	30.76	"
55.23	47.31	"
74.32	68.81	"
16.78	124.96	$C_7H_5O_3Na$
13.22	121.27	"
9.03	120.54	"
0	115.43	"

Results at 40°.

Gms per 100 Gms H_2O $C_8H_{10}N_4O_2$	$C_7H_5O_3Na$	Solid Phase
4.64	0	$C_8H_{10}N_4O_2.H_2O$
59.49	37.47	"
86.49	62.47	"
95.94	69 15	"
26 93	131.52	$C_7H_5O_3Na$
10.75	124.35	"
0	119.66	"

Data for the depression of the freezing-point of sodium salicylate solutions by caffeine and theobromine are also given.

DISTRIBUTION OF CAFFEINE BETWEEN WATER AND CHLOROFORM. (Marden, 1914.)

Grams Caffeine in: 105 cc. H_2O Layer	50 cc $CHCl_3$ Layer.	Ratio of Caffeine in Equal Vols H_2O and $CHCl_3$.
0.0090	0.0563	0.0456
0.0180	0.1048	0.0492
0.0291	0.1770	0.0470

CALCIUM ACETATE $Ca(CH_3COO)_2.2H_2O$.

SOLUBILITY IN WATER. (Lumsden, 1902; Krasnicki, 1887.)

t°.	Gms. $Ca(CH_3COO)_2$ per 100 Gms. Solution.	Water.	Solid Phase.	t°.	Gms. $Ca(CH_3COO)_2$ per 100 Gms Solution.	Water.	Solid Phase.
0	27.2	37.4	$Ca(CH_3COO)_2.2H_2O$	60	24.6	32.7	$Ca(CH_3COO)_2\ 2H_2O$
10	26.5	36.0	$Ca(CH_3COO)_2.2H_2O$	80	25.1	33 5	$Ca(CH_3COO)_2\ 2H_2O$
20	25.8	34.7	$Ca(CH_3COO)_2.2H_2O$	84	25.3	33.8	$Ca(CH_3COO)_2.2H_2O$
25	25.5	34.2	$Ca(CH_3COO)_2.2H_2O$	85	24.7	32.9	$Ca(CH_3COO)_2.H_2O$
30	25.3	33.8	$Ca(CH_3COO)_2\ 2H_2O$	90	23.7	31.1	$Ca(CH_3COO)_2.H_2O$
40	24.9	33.2	$Ca(CH_3COO)_2.2H_2O$	100	22.9	29.7	$Ca(CH_3COO)_2.H_2O$

SOLUBILITY OF CALCIUM ACETATE IN AN AQUEOUS SATURATED SOLUTION OF SUGAR AT 31.25°. (Kohler, 1897.)

100 gms. solution contain 8.29 gms. $Ca(CH_3COO)_2$ + 60.12 gms. sugar.
100 gms. water dissolve 26.3 gms. $Ca(CH_3COO)_2$ + 190.3 gms. sugar.

100 cc. anhydrous hydrazine dissolve 1 gm. calcium acetate at room temp. (Welsh and Broderson, 1915.)

CALCIUM (Tri) Methyl **ACETATE** $Ca[(CH_3)_3CCOO]_2$.

CALCIUM (Di) Ethyl **ACETATE** $Ca[(C_2H_5)_2CHCOO]_2$.

CALCIUM Methyl Ethyl **ACETATE** $Ca[CH_3(C_2H_5).CHCOO]_2$.

SOLUBILITY OF EACH IN WATER.

(Landau — Monatsh. Chem. 14, 717, '93; Keppish — *Ibid.* 9, 600, '88; Sedlitzki — *Ibid.* 8, 573, '87.)

t°.	Ca. Tri Methyl Acetate. Gms. $Ca(C_5H_9O_2)_2$ per 100 Gms. Water.	Solution.	Ca. Di Ethyl Acetate. Gms. $Ca(C_6H_{11}O_2)_2$ per 100 Gms. Water.	Solution.	Ca. Methyl Ethyl Acetate. Gms. $Ca(C_5H_9O_2)_2$ per 100 Gms. Water.	Solution.
0	7.30	6.81	30.3	23.22	28.78	22.35
10	6.84	6.40	27.8	21.75	31.71	24.07
20	6.54	6.14	25.6	20.38	33.76	25.23
30	6.40	6.01	23.7	19.16	34.92	25.89
40	6.44	6.05	22.1	18.10	35.20	26.04
50	6.64	6.22	20.8	17.22	34.60	25.71
60	6.86	6.42	19.9	16.60	33.11	24.89
70	7.11	6.64	19.2	16.11	30.74	23.41
80	7.38	6.87	...	...	27.49	21.56

CALCIUM Methyl Propyl **ACETATE** $Ca[CH_3(C_3H_7).CHCOO]_2$.

CALCIUM (Di) Propyl **ACETATE** $Ca[(C_3H_7)_2CHCOO]_2$.

CALCIUM (Iso) Butyl **ACETATE** $Ca[(CH_3)_2CH(CH_2)_2COO]_2$.

SOLUBILITY OF EACH IN WATER.

(Stiassny — Monatsh. Chem. 12, 596, '91; Furth — *Ibid.* 9, 313, '88; König — *Ibid.* 15, 22, '94.)

t°.	Ca. Methyl Propyl Acetate. Gms. $Ca(C_6H_{11}O_2)_2$ per 100 Gms. Water	Solution.	Ca. Di Propyl Acetate. Gms. $Ca(C_8H_{15}O_2)_2$ per 100 Gms. Water.	Solution.	Ca. Iso Butyl Acetate. Gms. $Ca(C_6H_{11}O_2)_2$ per 100 Gms. Water.	Solution.
0	16.58	14.22	9.57	8.73	7.48	6.96
10	15.80	13.65	8.35	7.71	6.38	5.99
20	15.14	13.15	7.19	6.71	5.66	5.36
30	14.61	12.75	6.11	5.77	5.31	5.04
40	14.21	12.45	5.09	4.84	5.31	5.04
50	13.94	12.24	4.14	3.98	5.68	5.37
60	13.79	12.13	3.25	3.15	6.41	6.02
70	13.78	12.12	2.44	2.38	7.51	6.98
80	13.89	12.20	1.65	1.62	8.97	8.23
90	...	...	...	...	10.79	9.74

CALCIUM BENZOATE $Ca(C_6H_5COO)_2$.

100 cc. sat. solution in water contain 3.02 gms. $Ca[C_6H_5COO]_2$ at 26°. (de Jong, 1912.)

100 gms. sat. solution in water contain 8.6 gms. $Ca[C_6H_5COO]_2$ at 15° and 10.2 gms. at 100°. (Tarugi and Checchi, 1901.)

CALCIUM BORATES $CaB_2O_4.4H_2O$, $CaB_2O_4.6H_2O$.

SOLUBILITY OF EACH SEPARATELY IN WATER.

(Mandelbaum, 1909.)

t°.	Gms. per 100 Gms. Sat. Sol. B_2O_3.	CaB_2O_4.	Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol. B_2O_3.	CaB_2O_4.	Solid Phase.
30	0.0365	0.310	$CaB_2O_4.4H_2O$	30	0.0205	0.254	$CaB_2O_4.6H_2O$
50	0.036	0.307	" (amorphous)	50	0.032	0.353	" (cryst.)
70	0.048	0.392	"	70	0.068	0.457	"
90	0.0315	0.310	"	90	0.0675	0.359	"

SOLUBILITY OF CALCIUM BORATES IN AQUEOUS SOLUTIONS OF BORIC ACID AT 30°.

(Sborgi, 1913.)

Gms. per 100 Gms. Sat. Sol. B_2O_3.	Gms. per 100 Gms. Sat. Sol. CaO.	Solid Phase.	Gms. per 100 Gms Sat Sol. B_2O_3.	Gms. per 100 Gms Sat Sol. CaO.	Solid Phase.
0.014	0.126	$Ca(OH)_2$	0.869	0.067	2.3.9
0.032	0.140	"	1.116	0.076	"
0.098	0.194	"	1.339	0.093	" +1.3.12
0.127	0.217	" +1.1.6	2.058	0.093	1.3.12
0.134	0.220	1.1.6	2.509	0.099	"
0.138	0.118	"	2.730	0.111	"
0.162	0.106	"	3.732	0.325	"
0.166	0.107	" +2.3.9	2.798	0.109	"
0.171	0.109	" "	3.313	0.143	"
0.290	0.052	2.3.9	3.841	0.152	"
0.610	0.054	"	4.250	0.155	" $+H_3BO_3$
0.767	0.059	"	4.179	0.137	H_3BO_3

1.1.6 = $CaO.B_2O_3.6H_2O$, 2.3.9 = $2CaO.3B_2O_3.9H_2O$, 1.3.12 = $CaO.3B_2O_3.12H_2O$.

Many determinations, in addition to the above, are given in the original paper.

CALCIUM BROMIDE $CaBr_2.6H_2O$.

SOLUBILITY IN WATER.

(Kremers, 1858; Etard, 1894, gives results which yield an irregular curve and are evidently less accurate than those of Kremers)

t°.	Gms. $CaBr_2$ per 100 Gms. Water.	Gms. $CaBr_2$ per 100 Gms. Solution.	Solid Phase.	t°.	Gms $CaBr_2$ per 100 Gms. Water.	Gms $CaBr_2$ per 100 Gms. Solution.	Solid Phase.
—22*	101	50.5	$CaBr_2.6H_2O$+Ice	34.2†	185	65.1	$CaBr_2.6H_2O+CaBr_2.4H_2O$
0	125	55.5	$CaBr_2.6H_2O$	40	213	68.1	$CaBr_2.4H_2O$
10	132	57	"	60	278	73.5	"
20	143	58.8	"	80	295	74.7	"
25	153	60.5	"	105	312	75.7	"

* Eutec. † tr. pt.

Density of saturated solution at 20° = 1.82.

Data for the system calcium bromide, calcium oxide and water at 25° are given by Milikau (1916).

Freezing-point data are given for mixtures of calcium bromide and calcium chloride, calcium bromide and calcium fluoride by Ruff and Plato, 1903.

CALCIUM PerBROMIDE $CaBr_4$.

Data for the formation of calcium perbromide in aqueous solutions at 25° are given by Herz and Bulla (1911). The experiments were made by adding bromine to aqueous solutions of $CaBr_2$ and agitating with carbon tetrachloride. From the bromine content of the CCl_4 layer, the amount of free bromine in the aqueous layer can be calculated on the basis of the distribution ratio of bromine between water and CCl_4. This furnishes the necessary data for calculating the amount of calcium perbromide existing in the aqueous layer.

CALCIUM (Normal) BUTYRATE $Ca[CH_3(CH_2)_2COO]_2.H_2O$.

CALCIUM (Iso) BUTYRATE $Ca[(CH_3)_2CH.COO]_2.5H_2O$.

SOLUBILITY OF EACH IN WATER.

(Lumsden — J. Chem. Soc. 81, 355, '02; see also Chancel and Parmentier — Compt. rend. 104, 474, '87; Deszathy — Monatsh. Chem. 14, 251, '93, and also Hecht — Liebig's Annalen 213, 72, '82, give results for the normal salt which are somewhat below those of Lumsden for the lower temperatures. Sedlitzki — Monatsh. Chem. 8, 566, '87, gives slightly different results for the iso salt.)

Calcium Normal Butyrate.

t°.	Gms. $Ca(C_4H_7O_2)_2$ per 100 Gms. Water.	Gms. $Ca(C_4H_7O_2)_2$ per 100 Gms. Solution.
0	20.31	16.89
10	19.15	16.08
20	18.20	15.39
25	17.72	15.05
30	17.25	14.71
40	16.40	14.09
60	15.15	13.16
80	14.95	13.01
100	15.85	13.69

Calcium Iso Butyrate.

t°.	Gms. $Ca(C_4H_7O_2)_2$ per 100 Gms. Water.	Gms. $Ca(C_4H_7O_2)_2$ per 100 Gms. Solution.	Solid Phase.
0	20.10	16.78	$Ca(C_4H_7O_2)_2.5H_2O$
20	22.40	18.30	"
30	23.80	19.23	"
40	25.28	20.65	"
60	28.40	22.12	"
62	28.70	22.30	"
65	28.25	22.03	$Ca(C_4H_7O_2)_2.H_2O$
80	27.00	21.26	"
100	26.10	20.69	"

CALCIUM *d* CAMPHORATE $C_{10}H_{14}O_4Ca.7H_2O$.

SOLUBILITY OF CALCIUM CAMPHORATE IN AQUEOUS SOLUTIONS OF CAMPHORIC ACID AT 15° AND VICE VERSA.

(Jungfleisch and Landrieu, 1914)

Gms. per 100 Gms. Sat. Sol. $C_8H_{14}(COOH)_2$	Gms. per 100 Gms. Sat. Sol. $C_{10}H_{14}O_4Ca$.	Solid Phase.
1.35	1.23	$C_8H_{14}(COOH)_2$
1.57	1.97	"
1.71	2.55	"
2.18	4.34	"
2.33	4.73	"
2.90	7.75	$C_8H_{14}(COOH)_2$
3	8.66	" $+C_{10}H_{14}O_4.Ca.7H_2O$
3.07	8.57	$C_{10}H_{14}O_4Ca.7H_2O$
1.50	7.94	"
0	7.37	"

Calcium camphorate tetrahydrate exists at higher temperatures. Its solubility at 100° was found to be 8.68 gms. $C_{10}H_{14}O_4Ca$ per 100 gms. sat. solution. By careful work, the result at 15° for $C_{10}H_{14}O_4Ca.4H_2O$ was found to be 12.21 gms. $C_{10}H_{14}O_4Ca$ per 100 gms. sat. solution.

CALCIUM CAPROATE (Hexoate) $Ca[CH_3(CH_2)_4COO]_2.H_2O$.

CALCIUM 3 Methyl PENTANATE $Ca[CH_3.CH_2.CH(CH_3)CH_2.COO]_2.3H_2O$.

CALCIUM CAPRYLATE $Ca[CH_3(CH_2)_6COO]_2.H_2O$.

SOLUBILITY OF EACH IN WATER.

(Lumsden; the Pentanate, Kulish, 1893; see also Keppish, 1888, and Altschul, 1896, for results on the Caproate.)

t°.	Ca. Caproate. Gms. $Ca(C_6H_{11}O_2)_2$ per 100 Gms. H_2O.	Ca. 3 Methyl Pentanate. Gms. $Ca(C_6H_{11}O_2)_2$ per 100 Gms. Water.	Ca. 3 Methyl Pentanate. Gms. $Ca(C_6H_{11}O_2)_2$ per 100 Gms. Solution.	Ca. Caprylate. Gms. $Ca(C_8H_{15}O_2)_2$ per 100 Gms. H_2O.
0	2.23	12.33	10.98	0.33
20	2.18	17.18	14.66	0.31
40	2.15	18.99	15.97	0.28
50	2.10	18.73	15.78	0.26
60	2.15	17.71	15.04	0.24
80	2.30	13.37	11.80	0.32
100	2.57	9.94	9.04	0.50

CALCIUM CARBONATE $CaCO_3$.

EQUILIBRIUM IN THE SYSTEM $CaO-H_2O-CO_2$ AT 16°.

The following data for the solubility of calcite ($CaCO_3$) in water at 16° in contact with air containing the partial pressure P of CO_2 were calculated from the results of Schloesing (1872), Engel (1888), and others by Johnston (1915) and Johnston and Williamson (1916). These authors describe the changes in the system resulting from a gradual increase in partial pressure of CO_2, as follows:

"We begin by considering the equilibrium between the hydroxide $M(OH)_2$ and the aqueous solution saturated with it as affected by a progressive increase from zero of the partial pressure P of CO_2 in the atmosphere in contact with the solution. Addition of CO_2 is followed by a distribution between the vapor and liquid phases until there is equilibrium between the residual partial pressure of CO_2 and the H_2CO_3 in solution, and in turn between the latter and the several ions; the net effect of this is a definite decrease in $[OH^-]$, the concentration of hydroxide ion, which necessitates that more of the hydroxide dissolve in order to keep the solubility-product $[M^{++}][OH^-]^2$ constant. Consequently the total concentration of M^{++} increases, part of it being now associated with carbonate and bicarbonate; in other words, the apparent solubility of the base increases if the method of analysis of the solution is a determination of M, whereas it would decrease if one should determine $[OH^-]^2$. This process continues until the product $[M^{++}][CO_3^{=}]$ reaches the value requisite for the precipitation of MCO_3 (on the assumption that supersaturation does not occur) which, for a given base, takes place at a definite value of P which depends only upon the temperature; this transition pressure P_1 is, at a given temperature, the highest under which solid hydroxide is stable and the lowest at which solid carbonate is stable.

At P_1 the solubility (as measured by the total [M]) begins to diminish, because increase of P increases $[CO_3^{=}]$ while the product $[M^{++}][CO_3^{=}]$ must remain constant so long as MCO_3 is the stable solid phase; this increase of $[CO_3^{=}]$ continues until a definite pressure P_0 is reached, when the formation of bicarbonate in the solution becomes the predominant reaction and $[CO_3^{=}]$ begins to decrease again. P_0 is thus a minimum in the solubility curve. With further increase beyond P_0 the concentration of both M^{++} and HCO_3^- increases steadily until the precipitation value of the product $[M^{++}][HCO_3^-]^2$ is reached at P_2, which is a transition pressure at which both carbonate and bicarbonate are present as stable solid phases. Beyond P_2 bicarbonate alone is stable, and its total solubility falls off very slowly with further increase of partial pressure of CO_2."

THE CALCULATED ION-CONCENTRATIONS AND SOLUBILITY OF CALCITE IN WATER AT 16° IN CONTACT WITH AIR CONTAINING THE PARTIAL PRESSURE P OF CO_2.

Partial Pressure P of CO_2 Measured in Atmospheres.	Ion-concentrations per Liter $\times 10^{-4}$.				Total Ca, Mols per Liter $\times 10^{-4}$.	Grams $CaCO_3$ per Liter
	Ca^{++}.	OH^-.	$CO_3^{=}$.	HCO_3^-.		
3.16×10^{-14}	138.5	277	0.0071	0.0000235	...	2
2.80×10^{-10}	6.81	13.3	0.144	0.01	...	0.074
9.78×10^{-9}	2.377	3.82	0.414	0.10	...	0.026
6.14×10^{-8}	1.654	1.82	0.593	0.30	...	0.018
2.19×10^{-7}	1.476	1.02	0.665	0.60	...	0.016
3.73×10^{-7}	1.459	0.787	0.672	0.787	...	0.0159
3.85×10^{-7}	1.459	0.774	0.672	0.80	...	0.0159
6.07×10^{-7}	1.473	0.614	0.666	1	...	0.016
7.62×10^{-6}	2.051	0.147	0.478	3	...	0.022
7.63×10^{-5}	3.777	0.034	0.260	7	...	0.040
2.15×10^{-4}	5.197	0.0174	0.188	10	...	0.056
$2\ \times10^{-4}$	5.09	0.0182	0.19	9.96	5.52	0.055
2.5×10^{-4}	5.46	0.0157	0.18	10.54	5.93	0.059
$3\ \times10^{-4}$	5.79	0.0140	0.17	11.22	6.31	0.063
3.5×10^{-4}	6.08	0.0126	0.16	11.82	6.64	0.066
$4\ \times10^{-4}$	6.35	0.0115	0.16	12.36	6.94	0.069
4.5×10^{-4}	6.59	0.0107	0.15	12.86	7.21	0.072
$5\ \times10^{-4}$	6.82	0.0100	0.14	13.32	7.46	0.075

THE SOLUBILITY OF CALCIUM CARBONATE (CALCITE) IN WATER AT 16° IN CONTACT WITH AIR CONTAINING PARTIAL PRESSURE P OF CO_2.

(Calc. from Schloesing, 1872, and Engel, 1888, by Johnston, 1915.)

Partial Pressure *P* of CO_2 in Atmospheres.	Total Ca, Mols. per Liter.	Total $Ca(HCO_3)_2$ Mols. per Liter.	Partial Pressure *P* of CO_2 in Atmospheres.	Total Ca, Mols. per Liter.	Total $Ca(HCO_3)_2$ Mols. per Liter
0.000504	0.000746	0.000731	0.4167	0.007825	0.007874
0.000808	0.000850	0.000837	0.5533	0.008855	0.008854
0.00333	0.001372	0.001364	0.7297	0.00972	0.00972
0.01387	0.002231	0.002226	0.9841	0.01086	0.01086
0.02820	0.002965	0.002961	1	0.01085	0.01085
0.05008	0.003600	0.003597	2	0.01411	0.01411
0.1422	0.005330	0.005328	4	0.01834	0.01834
0.2538	0.006634	0.006632	6	0.02139	0.02139

THE SOLUBILITY OF CALCIUM CARBONATE (CALCITE) IN WATER AT 25° IN CONTACT WITH CO_2 UNDER INCREASING PRESSURES. (McCoy and Smith, 1911.)

Approx. Pressure of CO_2 in Atmospheres.*	Mols. per Liter Sat Solution.		Gms per Liter Sat Sol.		Solid Phase.
	H_2CO_3.	$Ca(HCO_3)_2$.	H_2CO_3.	$Ca(HCO_3)_2$.	
0.1	0.003522	0.004116	0.22	0.67	$CaCO_3$
1.1	0.03728	0.009734	2.3	1.58	"
9.9	0.3329	0.02236	20.6	3.62	"
13.2	0.444	0.02495	27.5	4.04	"
16.3	0.550	0.02600	34.1	4.21	$Ca(HCO_3)_2$
25.4	0.858	0.02603	53.2	4.22	"

* Calc. by Henry's Law from CO_2 concentrations. See also remarks under Ferrous Bicarbonate, p. 336.

These results show that the solution becomes saturated with $Ca(HCO_3)_2$ at about 15 atmospheres pressure of CO_2, and it would be theoretically possible to convert all the $CaCO_3$ to $Ca(HCO_3)_2$ by introducing sufficient CO_2 at pressures greater than 15 atmospheres. Under the conditions of the present experiment, it was calculated that more than 3 months time would have been required for the complete conversion.

The solubility of calcium carbonate in water saturated with CO_2 at one atmosphere pressure was found by Cavazzi (1916) to be 1.56 gms. $CaCO_3$ at 0° and 1.1752 gms. at 15°. A supersaturated solution prepared by passing a rapid stream of CO_2 through sat. $Ca(OH)_2$ solution at 15° contained 2.29 gms. $CaCO_3$.

SOLUBILITY OF CALCIUM CARBONATE IN WATER AT 15°. (Treadwell and Reuter, 1896)

(Among the investigators who have reported results upon the solubility of calcium carbonate may be mentioned, Cossa, 1869; Schloesing, 1872, Caro, 1874; Reid, 1887–88; Irving and Young, 1888; Anderson, 1888–89; Engel, 1888; Lubavin, 1892; Pollacci, 1896)

cc. CO_2 per 100 cc. Gaseous Phase (0° and 760 mm).	Partial Pressure of CO_2 in mm. Hg.	Gms per 100 cc. Saturated Solution.		
		Free CO_2.	$Ca(HCO_3)_2$	Ca.
8.94	67.9	0.1574	0.1872	0.0462
6.04	45.9	0.0863	0.1755	0.0433
5.45	41.4	0.0528	0.1597	0.0394
2.18	16.6	0.0485	0.1540	0.0380
1.89	14.4	0.0347	0.1492	0.0368
1.72	13.1	0.0243	0.1331	0.0329
0.79	6	0.0145	0.1249	0.0308
0.41	3.1	0.0047	0.0821	0.0203
0.25	1.9	0.0029	0.0595	0.0147
0.08	0.6	...	0.0402	0.0099
...	...	...	0.0385	0.0095

Therefore 1 liter sat. solution at 15° and 0 partial pressure of CO_2 contains 0.385 gram $Ca(HCO_3)_2$. Determinations similar to the above, made in 0.1 *n* NaCl solutions at 15°, are also given. It is pointed out by Johnston (1915), that although Treadwell and Reuter made very painstaking analyses, their mode of working did not secure equilibrium conditions, a fact which is borne out by the lack of constancy of the calculated solubility-product constant.

SOLUBILITY OF CALCIUM CARBONATE (CALCITE) IN WATER IN CONTACT WITH AIR AT DIFFERENT TEMPERATURES.

(Wells, 1915)

(Joplin, Mo., calcite was used. The solutions were kept in a thermostat and agitated by a current of out-door air filtered through cotton and washed by water. The CO_2 content of the air varied from 3.02 to 3.27 parts per 10,000. The calcium content of the solutions was determined by titrating with 0.02 *n* $NaHSO_4$, using methyl orange as indicator. The solutions were slightly acid to phenolphthaleine, showing that the calcium was present chiefly as bicarbonate.)

t°.	Gms. $CaCO_3$ per Liter.
0	0.081
10	0.070
20	0.065
25	0.056 (0.046)
30	0.052
40	0.044
50	0.038 (0.029)

Results in parentheses by Kendall (1912). In connection with these it is stated by Johnston (1915), that assurance is wanting that the partial pressure of CO_2 was the same at both temperatures and the results are, therefore, not necessarily comparable.

SOLUBILITY OF CALCIUM CARBONATE IN WATER AT DIFFERENT TEMPERATURES AND IN CONTACT WITH AIR CONTAINING DIFFERENT PARTIAL PRESSURES OF CO_2.

(Leather and Sen, 1909)

Results at 15°.			Results at 25°.			Results at 40°.		
Partial Pressure CO_2 in Gas Phase.	Gms per Liter Sol.		Partial Pressure CO_2 in Gas Phase.	Gms per Liter Sol.		Partial Pressure CO_2 in Gas Phase	Gms. per Liter Sol.	
	$CaCO_3$.	CO_2.		$CaCO_3$	CO_2.		$CaCO_3$.	CO_2.
0.8	0.193	0.117	0.7	0.159	0.091	0.6	0.136	0.078
1.5	0.193	0.152	1.6	0.177	0.111	1.7	0.143	0.085
1.7	0.238	0.135	4.6	0.341	0.208	2.9	0.175	0.106
6.8	0.445	0.327	7.8	0.446	0.301	3.5	0.232	0.169
9.9	0.627	0.456	16.5	0.539	0.522	7	0.284	0.234
13.6	0.723	0.560	30.1	0.743	0.715	14.9	0.384	0.293
14.6	0.686	0.623	35.5	0.755	0.803	22.2	0.427	0.333
31.6	1.050	1.117				31.7	0.480	0.476

Similar results also given for 20°, 30° and 35°.

The mixtures were constantly agitated at constant temperature. The solid phase in each case was found to be $CaCO_3$ and it is concluded that $Ca(HCO_3)_2$ cannot exist in this solid state above 15°.

In discussing the experiments of Leather and Sen, Johnston (1915) points out that their method of analysis gives low results for CO_2. A calculation of the data yields very irregular results and the most that can be deduced from them is that the solubility-product constant of calcite probably decreases somewhat with temperature, becoming apparently about 0.5×10^{-8} at 40°.

Data for the solubility of $CaCO_3$ in boiling water are given by Cavazzi (1917).

Data for the solubility of calcium carbonate in water containing excess of carbon dioxide are also given by Seyler and Lloyd (1909). The experiments were made at room temperature. Additional experiments showed that small amounts of $CaCl_2$, $CaSO_4$ or $NaHCO_3$ did not affect the solubility-product constant. Small amounts of NaCl, Na_2SO_4 and $MgSO_4$, containing no ion in common with $CaCO_3$, resulted in an increase of the total calcium in the solution.

Data for the solubility of calcium carbonate in water, determined by the conductivity method, are given by Holleman and by Kohlrausch and Rose (1893).

SOLUBILITY OF CALCIUM CARBONATE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE.

Results at 12°–18°. (Cantoni and Goguelia, 1905) (Flasks allowed to stand 98 days.)

Gms. per Liter Sat. Sol. NH₄Cl.	CaCO₃.
53.5	0.423
100	0.609
200	0.645

Results at 25°. (Rindell, 1910.) (Constant agitation 24 hrs.)

Gms. per Liter Sat. Sol. NH_4Cl.	$CaCO_3$.
6.7	0.285
13.4	0.373
26.8	0.502
53.5	0.678

Results at 60° for Calcite and Aragonite. (Warynski and Kouropatwinska, 1916.)

Gms. per Liter. NH_4Cl.	Calcite.	Gms. per Liter. NH_4Cl.	Aragonite.
0	0.028	0	0.041
1.07	0.164	1.07	0.184
5.35	0.333	5.35	0.371
10.70	0.453	10.70	0.505
26.76	0.664	26.76	0.728
53.52	0.934	53.52	1.015
160.56	1.21	160.56	1.36

SOLUBILITY OF CALCIUM CARBONATE IN AQUEOUS SOLUTIONS OF AMMONIUM NITRATE AND OF TRIAMMONIUM CITRATE.

In Aq. NH_4NO_3 at 18°. (Berju and Kosminiko, 1904.)

Gms. per Liter Sat. Sol. NH_4NO_3.	$CaCO_3$.
0	0.131
5	0.211
10	0.258
20	0.340
40	0.462
80	0.584

In Aq. NH_4NO_3 at 25°. (Rindell, 1910)

Gms. per Liter Sat. Sol. NH_4NO_3.	$CaCO_3$.
5	0.200
10	0.278
20	0.383
40	0.526

In Aq. Triammonium Citrate at 25°. (Rindell, 1910)

Mols. Citrate per Liter.	Gms. $CaCO_3$ per Liter.
0.0625	1.492
0.125	2.264
0.250	3.980
0.500	6.687

SOLUBILITY OF CALCIUM CARBONATE IN AQUEOUS SOLUTIONS OF MAGNESIUM CHLORIDE, MAGNESIUM SULFATE, SODIUM CHLORIDE AND SODIUM SULFATE UNDER CO_2 PRESSURE OF TWO ATMOSPHERES. (Ehlert and Hempel, 1912)

Aq. Salt Solution.	t°.	Gms. Hydrated Salt per 1000 Gms. H_2O.	Gms. $CaCO_3$ per 1000 cc. Solvent.	Aq. Salt Solution.	t°.	Gms. Hydrated Salt per 1000 Gms. H_2O	Gms. $CaCO_3$ per 1000 cc. Solvent.
$MgCl_2.6H_2O$	5	0	2.337	NaCl	5	50	3.740
"	5	6.1	2.352	"	5	86	3.783
"	5	50	3.404	"	5	106.9	3.690
"	5	86.9	4.083	"	5	175.6	3.350
"	5	350	3.301	"	5	263.4	2.811
"	5	700	2.736	"	8	351.2	2.163
"	5	1150	2.205	$MgSO_4.7H_2O$	14	105.3	2.177
"	5	1725	1.706	"	14	(sat.)	0.914
"	5	2300 sat.	1.406	$Na_2SO_4.10H_2O$	14	137.7	1.406
NaCl	5	28	3.280	"	14	(sat.)	1.920

SOLUBILITY OF CALCIUM CARBONATE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AND OF POTASSIUM SULFATE AT 25°. (Cameron and Robinson, 1907.)

Results for Aqueous KCl:

In contact with air. Gms. per 100 Gms. Sat. Sol. KCl.	$CaCO_3$	In contact with 1 atmosphere of CO_2. Gms. per 100 Gms. Sat. Sol. KCl	$CaCO_3$.
0	0.0013	0	0.062
3.9	0.0078	3.9	0.145
7.23	0.0078	7.23	0.150
13.82	0.0072	13.82	0.165
18.21	0.0070	18.21	0.154
26	0.0060	26	0.126

Results for Aqueous K_2SO_4:

In contact with air. Gms. per 100 Gms. Sat. Sol. K_2SO_4.	$CaCO_3$.	In contact with 1 atmosphere of CO_2. Gms. per 100 Gms. Sat. Sol. K_2SO_4	CaO.
1.60	0.0104	0.69	0.69
3.15	0.0116	1.37	0.69
4.73	0.0132	1.67	0.47*
6.06	0.0148	2.18	0.30*
8.88	0.0192	2.99	0.24*
10.48	0.0188		

* Solid phase syngenite.

One liter aqueous solution containing 223.8 gms. KCl dissolves 0.075 gm. calcite at 60°.

One liter aqueous solution containing 223.8 KCl dissolves 0.093 gm. aragonite at 60°. (Warynski and Kouropatwinska, 1916.)

SOLUBILITY OF CALCIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT 25°.

Solutions in contact with.

CO$_2$ Free Air. (Cameron, Bell and Robinson, 1907.) Gms. per 100 Gms. H$_2$O.		Ordinary Air. (Cameron and Seidell, 1902.) Gms. per 100 cc. Sat. Sol.		CO$_2$ at One Atmos. Pressure. (Cameron, Bell and Robinson, 1907) Gms. per 100 Gms. H$_2$O.	
NaCl.	CaCO$_3$.	NaCl.	CaCO$_3$.	NaCl.	CaCO$_3$.
1.60	0.0079	1	0.0112	1.49	0.150
5.18	0.0086	4	0.0140	5.69	0.160
9.25	0.0094	8	0.0137	11.06	0.174
11.48	0.0104	10	0.0134	15.83	0.172
16.66	0.0106	15	0.0119	19.62	0.159
22.04	0.0115	20	0.0106	29.89	0.123
30.50	0.0119	25	0.0085	35.85	0.103

Data for the solubility of calcium carbonate in aqueous solutions of mixtures of sodium chloride and sodium sulfate in contact with air and with CO$_2$ are given by Cameron, Bell and Robinson (1907).

Data for solubility of CaCO$_3$ in aqueous NaCl and other salt solutions, determined by boiling and cooling the solution, are given by Gothe (1915).

Data for the solubility of mixtures of calcium carbonate and calcium sulfate in aqueous solutions of sodium chloride at 25°, are given by Cameron and Seidell (1901).

Data for the solubility of mixtures of calcium carbonate and calcium sulfate in aqueous solutions of mixtures of sodium chloride and sodium sulfate at 25°, in contact with air and with CO$_2$, are given by Cameron, Bell and Robinson (1907).

One liter aqueous solution containing 175.5 gms. NaCl dissolves 0.062 gm. calcite at 60°.

One liter aqueous solution containing 175.5 gms. NaCl dissolves 0.071 gm. aragonite at 60°. (Warynski and Kouropatwinska, 1916.)

SOLUBILITY OF CALCIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE IN CONTACT WITH CO$_2$ FREE AIR.

(LeBlanc and Novotny, 1906)

Solvent.	Gms. CaCO$_3$ per Liter Sat. Sol. At 18°.	At 95°-100°.
Water	0.0128	0.0207
About 0.0001 *n* NaOH	0.0087	0.0096
" 0.0010 *n* "	0.0042	0.0069
" 0.0100 *n* "	0.0042	0.0057

Data on the equilibrium in aqueous solutions of CaCO$_3$, Na$_2$CO$_3$ and NaOH are given by Wegscheider and Walter (1907).

SOLUBILITY OF CALCIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE.

Solutions in contact with:

CO$_2$ Free Air at 25°. (Cameron, Bell and Robinson, 1907.) Gms per 100 Gms H$_2$O		Ordinary Air at 24°. (Cameron and Seidell, 1902)	
Na$_2$SO$_4$.	CaCO$_3$.	Gms. Na$_2$SO$_4$ per Liter.	Gms Total Ca per Liter Calc. as Ca(HCO$_3$)$_2$.
0.97	0.0151	5	0.175
1.65	0.0180	10	0.232
4.90	0.0262	20	0.277
12.69	0.0313	40	0.332
14.55	0.0322	80	0.400
19.38	0.0346	150	0.510
23.90	0.0360	250	0.725

Freezing-point data for mixtures of calcium carbonate and calcium chloride are given by Sackur (1911-12).

CALCIUM CHLORATE $Ca(ClO_3)_2.2H_2O$.

100 grams saturated aqueous solution contain 64 grams $Ca(ClO_3)_2$ at 18°. Density of solution is 1.729. (Mylius and Funk, 1897.)

CALCIUM CHLORIDE $CaCl_2$.

SOLUBILITY IN WATER

(Roozeboom — Z. physik. Chem. 4, 42, '89; see also Mulder; Ditte — Compt. rend. 92, 242, '81; Engel — Ann. chim. physic. [6] 13, 381, '88; Etard — *Ibid.* [7] 2, 532, '94.)

t°.	Gms. $CaCl_2$ per 100 Gms. Water.	Gms. $CaCl_2$ per 100 Gms. Solution.	Solid Phase.	t°.	Gms. $CaCl_2$ per 100 Gms. Water.	Gms. $CaCl_2$ per 100 Gms. Solution.	Solid Phase.
−55	42.5	29.8	Ice + $CaCl_2.6H_2O$	60	136.8	57.8	$CaCl_2.2H_2O$
−25	50.0	33.3	$CaCl_2.6H_2O$	70	141.7	58.6	$CaCl_2.2H_2O$
0	59.5	37.3	$CaCl_2.6H_2O$	80	147.0	59.5	$CaCl_2.2H_2O$
10	65.0	39.4	$CaCl_2.6H_2O$	90	152.7	60.6	$CaCl_2.2H_2O$
20	74.5	42.7	$CaCl_2.6H_2O$	100	159.0	61.4	$CaCl_2.2H_2O$
30.2	102.7	50.7	$CaCl_2.6H_2O$	120	173.0	63.4	$CaCl_2.2H_2O$
20	91.0	47.6	$CaCl_2.4H_2O\alpha$	140	191.0	65.6	$CaCl_2.2H_2O$
29.8	100.6	50.1	$.4H_2O\ \alpha + .6H_2O$	160	222.5	69.0	$CaCl_2.2H_2O$
40	115.3	53.4	$.4H_2O\ \alpha$.	170	255.0	71.8	$CaCl_2.2H_2O$
20	104.5	51.1	$CaCl_2.4H_2O\ \beta$	175.5	297.0	74.8	$CaCl_2.2H_2O + CaCl_2.H_2O$
29.2	112.8	53.0	$.4H_2O\ \beta + .6H_2O$	180	300.0	75.0	$CaCl_2.H_2O$
35	122.5	55.0	$.4H_2O\ \beta$	200	311.0	75.7	$CaCl_2.H_2O$
38.4	127.5	56.0	$.4H_2O\ \beta + CaCl_2.2H_2O$	235	332.0	76.8	$CaCl_2.H_2O$
45.3	130.2	56.6	$.4H_2O\ \alpha + CaCl_2.2H_2O$	260	347.0	77.6	$CaCl_2.H_2O$

Density of saturated solution at 0° = 1.367, at 15° = 1.399, at 18° = 1.417; at 25° = 1.47.

SOLUBILITY OF CALCIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 0°.

(Engel, 1887.)

Gms. per 100 cc. Sat. Sol. $CaCl_2$.	Gms. per 100 cc. Sat. Sol. HCl.	d_0 of Sat. Sol.	Gms per 100 cc. Sat. Sol. $CaCl_2$	Gms per 100 cc. Sat. Sol. HCl.	d_0 of Sat. Sol.
51.45	0	1.367	29.84	15.84	1.283
46.45	3.32	1.344	20.12	23.15	1.250
42.80	5.83	1.326	11.29	34.62	1.238
36.77	10.66	1.310			

SOLUBILITY OF MIXTURES OF CALCIUM CHLORIDE, MAGNESIUM CHLORIDE AND CALCIUM MAGNESIUM DOUBLE CHLORIDE (TACHHYDRITE).

(Van't Hoff and Kenrick, 1912)

t°.	Gms. per 100 Gms H_2O. $CaCl_2$	Gms. per 100 Gms H_2O. $MgCl_2$.	Solid Phase.
16.7	41.2	31.6	$MgCl_2.6H_2O + CaCl_2.6H_2O$
21.95	57.1	26	" " +Tachhydrite
28.2	54.5	28.4	Tachhydrite + $MgCl_2.6H_2O$
116.7	0	85.63	" + " + $MgCl_2.4H_2O$
25	32.3	17.9	+ $CaCl_2.6H_2O$ + $CaCl_2.4H_2O$
28.2	80.1	16.1	" + $CaCl_2.4H_2O$
28.2	88.7	7.24	$CaCl_2.6H_2O + CaCl_2.4H_2O$

Tachhydrate = $2MgCl_2.CaCl_2.12H_2O$.

100 grams H_2O dissolve 63.5 grams $CaCl_2$ + 4.9 grams KCl at 7° (M).

100 grams H_2O dissolve 57.6 grams $CaCl_2$ + 2.4 grams NaCl at 4° (M).

100 grams H_2O dissolve 59.5 grams $CaCl_2$ + 4.6 grams NaCl at 7° (M).

100 grams H_2O dissolve 72.6 grams $CaCl_2$ + 16 grams NaCl at 15° (R).

(M) = Mulder. (R) = Rüdorff.

Solubility of Calcium Chloride in Aqueous Solutions of Sodium Chloride at 25° and Vice Versa.

(Cameron, Bell and Robinson, 1907.)

d_{25} Sat. Sol.	Gms. per 100 Gms. H_2O. CaCl₂.	NaCl.	Solid Phase.	d_{25} Sat. Sol.	Gms. per 100 Gms. H_2O $CaCl_2$	NaCl	Solid Phase.
...	84	0	$CaCl_2.6H_2O$	1.2653	30.08	10.70	NaCl
1.4441	78.49	1.846	" +NaCl	1.2367	19.53	18.85	"
1.3651	58.48	1.637	NaCl	1.2080	3.92	32.48	"
1.3463	53.47	1.799	"	1.2030	0	35.80	"
1.2831	36.80	7.77	"				

Solubility of Calcium Chloride in Aqueous Alcohol at Room Temperature.

(Bodtker, 1897)

Solution Used.	Vol. Per Cent Alcohol.	Gms. $CaCl_2$ per 5 cc. Sol.
15 Gms. $CaCl_2.6H_2O$ + 20 cc. alcohol	92.3	1.430
15 Gms. $CaCl_2.6H_2O$ + 20 cc. alcohol	97.3	1.409
15 Gms. $CaCl_2.6H_2O$ + 20 cc. alcohol	99.3	1.429
15 Gms. $CaCl_2.6H_2O$ + 20 cc. alcohol + 1 Gm. $CaCl_2$	99.3	1.529
15 Gms. $CaCl_2.6H_2O$+20 cc.: alcohol + 2 Gms. $CaCl_2$	99.3	1.561
" + 3 " "	99.3	1.590
" + 4 " "	99.3	1.641
" + 5 " "	99.3	1.709

Solubility of Calcium Chloride in Aqueous Solutions of Acetone at 20°.

(Frankforter and Cohen, 1914)

Measured amounts of acetone were added to known solutions of $CaCl_2$ in water, until opalescence, indicative of the separation of a second liquid layer, was observed. The composition of a large number of such mixtures gives the limiting values for the binodal curve of the system. Tie lines were also determined in several instances by using such quantities of the three components that an adequate amount of each layer would be formed to permit the determination of the $CaCl_2$ in it. The points thus located on the curve fix the tie lines, and from them the approximate position of the plait point can be estimated.

Points on the Binodal Curve at 20°.

Gms per 100 Gms Sat Sol. Acetone.	$CaCl_2$.
9	40.5* (solid phase $CaCl_2$)
22.7	38.16† (solid phase $CaCl_2$)
20.8	31.2
20.2	28
21	24.4
23	21.1
25	19.2
30	15.6
35	12.8
40	10.5
45 •	8.8
50	7.4
55	6.1
60	5
65	3.9
70	2.8
75	1.8
80 •	1
85	0.5
90	0.2
95	0.1

• Point on solubility curve. † Quadruple point.

Composition of Points Representing Tie Lines at 20°.

Gms per 100 Gms Upper Layer Acetone.	$CaCl_2$	Gms per 100 Gms. Lower Layer. Acetone.	$CaCl_2$.
90.2	0.186	28.5	16.61
83.3	0.628	34.6	12.97
81	0.948	40	10.6
78.5	1.321	43.5	9.36
60	5 (plait point)	60	5

Points on the Binodal Curve at Different Temperatures.

t°.	Gms per 100 Gms Sat Sol. Acetone	$CaCl_2$.
5	31.09	15.52
10	22.77	23.64
15	31.09	15.52
18	30.58	15.27
25	21.44	22.25
25	29.83	14.89
30	20.99	21.79
30	29.27	14.62
35	21.14	20.91
35	28.59	14.29
40	19.83	20.58
40	27.90	13.93

SOLUBILITY OF CALCIUM CHLORIDE IN A SATURATED SOLUTION OF SUGAR AT 31.25°.

(Köhler, 1897.)

100 grams saturated solution contain 42.84 grams sugar + 25.25 grams $CaCl_2$, or 100 grams water dissolve 135.1 grams sugar + 79.9 grams $CaCl_2$.

100 gms. 95% formic acid dissolve 43.1 gms. $CaCl_2$ at 19°. (Aschan, 1913.)

100 cc. anhydrous hydrazine dissolve 16 gms. $CaCl_2$ at room temp. (Welsh and Broderson, 1915.)

100 gms. propyl alcohol dissolve 10.75 gms. $CaCl_2$ (temp.?). (Schlamp, 1894.)

FREEZING-POINT DATA (Solubility, see footnote, p. 1) ARE GIVEN FOR THE FOLLOWING MIXTURES OF CALCIUM CHLORIDE AND OTHER SALTS.

$CaCl_2+CaF_2$ (1) (2)	$CaCl_2+PbCl_2$ (5) (6) (7)	$CaCl_2+AgCl$ (5)
$CaCl_2+CaI_2$ (1)	$CaCl_2+LiCl$ (7) (8)	$CaCl_2+SrCl_2$ (6) (7) (3) (10)
$CaCl_2+CaO$(3)	$CaCl_2+MgCl_2$ (5) (6)	$CaCl_2+SrO$ (3)
$CaCl_2+CaSiO_3$ (4)	$CaCl_2+MnCl_2$ (6) (7)	$CaCl_2+TlCl$ (9)
$CaCl_2+CaSO_4$ (3)	$CaCl_2+KCl$ (5) (3)	$CaCl_2+SnCl_2$ (5)
$CaCl_2+CuCl$ (5)	$CaCl_2+NaCl$ (5) (3)	$CaCl_2+ZnCl_2$ (5)

(1) = Ruff and Plato, 1903; (2) = Plato, 1907; (3) = Sackur, 1911-12; (4) = Karandeeff, 1910; (5) = Menge, 1911; (6) = Sandonnini, 1911; (7) = Sandonnini, 1913; (8) = Sandonnini, 1913; (9) = Korreng, 1914; (10) = Schaefer, 1914.

CALCIUM CHLORIDE ACETAMIDATE $CaCl_2.3CH_3CONH_2$.

SOLUBILITY IN ACETAMIDE AT VARIOUS TEMPERATURES, DETERMINED BY THE SYNTHETIC METHOD.

(Menschutkin, 1908)

t°.	Gms. per 100 Gms. Sat. Sol. $CaCl_2.3CH_3CONH_2$	$=CaCl_2$	Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol. $CaCl_2.3CH_3CONH_2$	$=CaCl_2$	Solid Phase.
82 m. pt.	0	0	CH_3CONH_2	100	65.6	25.3	1.3
78	8	3.1	"	150	70.5	27.1	"
74	15.4	5.9	"	165	74.8	28.8	"
66	27	10.4	"	175	80.6	31	"
54	39.2	15.1	"	180	85.5	32.9	"
46 Eutec.	45	17.3	" +1.6	184	90.5	34.8	"
58	48.5	18.7	1.6	186 tr. pt.	94.5	36.4	" $+CaCl_2$(?)
62	54.5	21	"	200	97.5	37.5	$CaCl_2$(?)
64 tr. pt.	62.1	23.9	1.6+1.3	210	100	38.5	"

1.6 = $CaCl_2.6CH_3CONH_2$. 1.3 = $CaCl_2.3CH_3CONH_2$.

CALCIUM CHLORIDE ACETIC ACIDATE $CaCl_2.4CH_3COOH$.

SOLUBILITY IN ACETIC ACID AT VARIOUS TEMPERATURES, DETERMINED BY THE SYNTHETIC METHOD.

(Menschutkin, 1906.)

t°.	Gms. per 100 Gms. Sat. Sol. $CaCl_2.4CH_3COOH$	$=CaCl_2$	Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol. $CaCl_2.4CH_3COOH$	$=CaCl_2$	Solid Phase.
16.2 m. pt.	0	0	CH_3COOH	40	54.7	17.3	1.4
15	18	5.7	"	45	63	19.9	"
14	27	8.5	"	50	69.5	21.9	"
13	34	10.7	"	60	79.5	25.1	"
11.1 Eutec.	42	13.3	" +1.4	65	84.5	26.7	"
30	47.6	15	1.4	70	91.2	28.8	"
35	50	15.8	"	73 m. pt.	100	31.6	"

1.4 = $CaCl_2.4CH_3COOH$.

CALCIUM CHLORIDE ALCOHOLATES $CaCl_2.3CH_3OH$, $CaCl_2.3C_2H_5OH$.

(The compounds were prepared by mixing anhydrous $CaCl_2$ with the alcohol. In the case of the methyl alcohol compound, the tri CH_3OH salt crystallizes above 55°, the tetra salt below this temperature.)

SOLUBILITY OF EACH IN THE RESPECTIVE ALCOHOL AT VARIOUS TEMPERATURES, DETERMINED BY THE SYNTHETIC METHOD.

(Menschutkin, 1906.)

Results for $CaCl_2.3CH_3OH$.

t°.	Gms. per 100 Gms. Sat. Sol. $CaCl_2.3CH_3OH$	$= CaCl_2$.	Solid Phase.	t°.	Gms per 100 Gms. Sat. Sol. $CaCl_2.3CH_3OH$	$= CaCl_2$.	Solid Phase.
0	33.3	17.85	1.4	95	66.3	35.5	1.3
10	37.6	20.15	"	115	70.3	37.6	"
20	42.2	22.6	"	135	75.2	40.3	"
30	47	25.2	"	155	81.8	43.8	"
40	52	27.8	"	165	86.2	46.2	"
50	57.3	30.7	"	170	89.5	47.9	"
55	60	32.1	"	174	93.5	50.1	"
56	61.3	32.8	"	177*	100	53.6	"
55	60.5	32.4	" +1.3	190	...	55.7	1.1(?)
75	63.1	33.8	1.3	215	...	57.7	"

Results for $CaCl_2.3C_2H_5OH$.

t°.	Gms per 100 Gms. Sat Sol. $CaCl_2.3C_2H_5OH$	$= CaCl_2$.
0	34.8	15.5
20	46	20.5
40	58.7	26.1
60	73	32.5
70	80.8	36
80	86.8	38.7
85	89.2	39.7
90	91.9	40.8
95	96.2	42.8
97*	100	44.5

* M. pt.

1.4 = $CaCl_2.4CH_3OH$. 1.3 = $CaCl_2.3CH_3OH$, 1.1 = $CaCl_2.CH_3OH$.

CALCIUM CHROMATE $CaCrO_4$.

SOLUBILITY OF THE SEVERAL HYDRATES IN WATER.

(Mylius and Wrochem — Wiss. Abh. p. t. Reichanstalt 3, 462, '00.)

t°.	Gms. $CaCrO_4$ per 100 Gms. Water.	Gms. $CaCrO_4$ per 100 Gms. Solution.	Mols. $CaCrO_4$ per 100 Mols. H_2O.
	Solid Phase, α $CaCrO_4.2H_2O$. (Monoclinic)		
0	17.3	14.75	2.0
18	16.68	14.3	1.93
20	16.6	14.22	1.93
30	16.5	13.89	1.85
45	14.3	12.53	1.65
	Solid Phase, β $CaCrO_4.2H_2O$ (Rhombic)		
0	10.9	9.8	1.25
18	11.5	10.3	1.33
40	11.6	10.4	1.34
	Solid Phase, $CaCrO_4.H_2O$.		
0	13.0	11.5	1.50
18	10.6	9.6	1.22
25	10.0	9.1	1.15
40	8.5	7.8	0.98
60	6.1	5.7	0.70
75	4.8	4.6	0.56
100	3.2	3.1	0.37

t°.	Gms $CaCrO_4$ per 100 Gms. Water.	Gms $CaCrO_4$ per 100 Gms. Solution.	Mols. $CaCrO_4$ per 100 Mols. H_2O.
	Solid Phase, $CaCrO_4.\frac{1}{2}H_2O$.		
0	7.3	6.8	0.84
18	4.8	4.4	0.51
31	3.84	3.7	0.44
38.5	2.67	2.6	0.31
50	1.63	1.6	0.19
60	1.13	1.1	0.13
100	0.81	0.8	0.09
	Solid Phase, $CaCrO_4$.		
0	4.5	4.3	0.52
18	2.32	2.27	0.27
31	2.92	1.89	0.22
50	1.12	1.11	0.13
60	0.83	0.82	0.11
70	0.80	0.79	0.09
100	0.42	0.42	0.05

Densities of the saturated solutions of the above several hydrates at 18° are: α $CaCrO_4.2H_2O$, 1.149; β $CaCrO_4.2H_2O$, 1.105; $CaCrO_4.H_2O$, 1.096; $CaCrO_4.\frac{1}{2}H_2O$, 1.044; $CaCrO_4$, 1.023.

100 cc. 29% alcohol dissolve 1.206 grams $CaCrO_4$.
100 cc. 53% alcohol dissolve 0.88 gram $CaCrO_4$.

(Fresenius — Z. anal. Chem. 30, 672, '91.)

CALCIUM CINNAMATE $Ca(C_6H_5.CH:CHCOO)_2.3H_2O$.

SOLUBILITY OF CALCIUM CINNAMATE AND ITS ISOMERS IN SEVERAL SOLVENTS.

Name of Salt.	Formula.	Solvent.	t°.	Gms. Anhydrous Salt per 100 Gms. Solvent.
Calcium Cinnamate	$Ca(C_6H_5CH:CHCOO)_2.3H_2O$	Water	2	0.19(1)
" "	"	"	15	0.21(2)
" "	"	"	26	0.24(1)
" "	"	"	100	1.15(2)
" Isocinnamate	$Ca(C_9H_7O_2)_2.2H_2O$	"	20	23.8 (3)
" "	"	Acetone	20	19.6 (3)
" Allocinnamate	$Ca(C_9H_7O_2)_2.3H_2O$	"	20	2 (3)
" "	$Ca(C_9H_7O_2)_2.2H_2O$	Water	20	10.2 (4)
" "	"	Acetone	18	2.7 (5)
" Hydrocinnamate	$Ca(C_9H_7O_2)_2?H_2O$	"	14	0.19(5)
" "	"	"	19	0.21(5)
" "	"	Water	27	4.25(3)
" "	"	Acetone	25	3.3 (3)

(1) = De Jong, 1909; (2) = Tarugi and Checchi, 1901; (3) = Michael, 1901; (4) = Liebermann, 1903; (5) = Michael and Garner, 1903.

CALCIUM CITRATE $Ca_3(C_6H_5O_7)_2.4H_2O$.

SOLUBILITY IN WATER AND IN ALCOHOL AT 18° AND AT 25°.
(Partheil and Hübner, 1903.)

Solvent.	Grams $Ca_3(C_6H_5O_7)_2.4H_2O$ per 100 Gms Solvent at: 18°.	25°.
Water	0.08496	0.0959
Alcohol (Sp. Gr. 0.8092 = 95%)	0.0065	0.0089

EQUILIBRIUM IN THE SYSTEM CALCIUM OXIDE-CITRIC ACID-WATER AT 30°.
(van Itallie, 1908.)

The compositions of the solid phases were determined by the "Rest Method" of Schreinemakers (1903). The results are presented in the triangular diagram and it was necessary to select the fictitious compound $C_6H_8O_7.1\frac{1}{2}H_2O$ instead of $C_6H_8O_7$ in order to keep the citrate component within the limits of the diagram. This is in harmony with the choice of anhydrides as components in the inorganic oxy acid systems.

Gms. per 100 Gms. Sat. Sol. $C_6H_8O_7.1\frac{1}{2}H_2O$.	CaO	Solid Phase.	Gms. per 100 Gms. Sat. Sol. $C_6H_8O_7.1\frac{1}{2}H_2O$.	CaO.	Solid Phase.
55.86	0	$C_6H_8O_7.H_2O$	20.3	0.35	$C_6H_6O_7Ca.4H_2O$
54.8	0.24	"	16.3	0.33	"
55.4	0.35	" $+(C_6H_7O_7)_2Ca.3H_2O$	12.5	0.39	"
53.7	0.40	$(C_6H_7O_7)_2Ca.3H_2O$	8.3	0.28	"
48.3	0.52	"	5.2	0.25	"
42.6	0.60	"	4.1	0.20	Quadruple pt.
38.5	0.77	"	3.2	0.20	...
36.5	0.70	" $+C_6H_6O_7Ca.4H_2O$	2.4-0	0.21-0.13	Hydrate of $(C_6H_5O_7)_2Ca_3(?)$
34.8	0.77	$C_6H_6O_7Ca.4H_2O$	0.18	0.24	Quadruple pt.
27.5	0.45	"	0	0.113	$Ca(OH)_2$

CALCIUM Potassium FERROCYANIDE $CaK_2Fe(CN)_6.3H_2O$.

100 parts H_2O dissolve 0.125 part salt at 15°, and 0.69 part at boiling-point. (Kunheim and Zimmerman, 1884.)

100 gms. H_2O dissolve 0.41 gm. $CaK_2Fe(CN)_6$ at 15-17°. (Brown, 1907.)

CALCIUM FLUORIDE CaF_2.

One liter sat. aqueous solution contains 0.016 gm. CaF_2 at 18° and 0.017 gm. at 26°.

One liter sat. aqueous solution contains 0.0131 gm. fluorspar at 0°, 0.0149 gm. at 15°, 0.0159 gm. at 25° and 0.0167 gm. at 40°. (Kohlrausch, 1904–05, 1908.)

Freezing-point data for mixtures of calcium fluoride and calcium iodide are given by Ruff and Plato (1903) and for mixtures of calcium fluoride and calcium silicate by Karandeeff (1910).

CALCIUM FORMATE $Ca(HCOO)_2$.

SOLUBILITY IN WATER.

(Lumsden, 1902; see also Krasnicki, 1887)

t°.	Gms. $Ca(HCOO)_2$ per 100 Gms. Water.	Gms. $Ca(HCOO)_2$ per 100 Gms. Solution.	t°.	Gms. $Ca(HCOO)_2$ per 100 Gms. Water.	Gms. $Ca(HCOO)_2$ per 100 Gms. Solution.
0	16.15	13.90	60	17.50	14.89
20	16.60	14.22	80	17.95	15.22
40	17.05	14.56	100	18.40	15.53

Results in good agreement with the above are given by Stanley (1904).

CALCIUM GLYCEROPHOSPHATES α = $OH.CH_2.CH(OH)CH_2.OPO_3Ca$, β = $OH.CH_2.CH.OPO_3Ca.CH_2OH$.

SOLUBILITY OF CALCIUM α GLYCEROPHOSPHATE IN WATER.

(Power and Tutin, 1905; Couch, 1917)

t°.	Gms $CaC_3H_7O_6P$ per 100 Gms. Sat. Sol.	t°.	Gms $CaC_3H_7O_6P$ per 100 Gms. Sat. Sol.
0	5	40	3.5
10	4.6	60	2.7
20	5.2	80	1.8
25	5	100	0.9

Results varying from 1.7 to 5.4 gms. per 100 gms. sat. solution at or near 18° are given by Rogier and Fiore (1913), Willstaetter (1904) and King and Pyman (1914). It is pointed out by Couch, however, that since the solubilities of the α and β isomer differ, and also that the commercial product contains both isomers, variable results will be obtained, depending on the composition of the product and the method used for determining the solubility. These authors also show that increasing amounts of alcohol in the solvent decrease the solubility of calcium glycerophosphate.

100 grams H_2O dissolve 1.66 grams calcium β glycerophosphate at 20°. (Couch, 1917.)

The results of King and Pyman (1914) are: 1.4 gms. at 13° and 1 gm. at 15°.

CALCIUM HEPTOATE (Oenanthate) $Ca[CH_3(CH_2)_5COO]_2.H_2O$.

SOLUBILITY IN WATER.

(Lumsden, 1902; see also Landau, 1893; Altschul, 1896)

t.	0°.	20°.	40°.	60°.	80°.	100°.
Gm. $Ca(C_7H_{13}O_2)_2$ per 100 gms. solution	0.94	0.85	0.81	0.81	0.97	1.24

CALCIUM HYDROXIDE $Ca(OH)_2$.

Recent determinations of the solubility of calcium hydroxide in water, agreeing fairly well with the average results given in the table on next page, are given by Bassett, Jr. (1908), Moody and Leyson (1908), Chugaev and Khlopin (1914) and Seliwanow (1914).

One liter sat. aqueous solution contains 0.305 gm. CaO at 120°, 0.169 gm. at 150° and 0.084 gm. at 190°. (Herold, 1905.)

One liter of aqueous 5.2% NH_3 solution dissolves 0.81 gm. $Ca(OH)_2$ at about 20°. (Konowalow, 1899b)

CALCIUM HYDROXIDE $Ca(OH)_2$.

Solubility in Water.

(Average curve from the results of Lamy, 1878; Maben, 1883–84; Herzfeld, 1897, and Guthrie, 1901.)

t°.	Grams per 100 Grams H_2O. $Ca(OH)_2$.	CaO.	t°.	Grams per 100 Grams H_2O. $Ca(OH)_2$.	CaO.
0	0.185	0.140	50	0.128	0.097
10	0.176	0.133	60	0.116	0.088
20	0.165	0.125	70	0.106	0.080
25	0.159	0.120	80	0.094	0.071
30	0.153	0.116	90	0.085	0.064
40	0.141	0.107	100	0.077	0.058

Solubility of Calcium Hydroxide in Aqueous Solutions of Ammonium Chloride at 25°.

(Noyes and Chapin — Z. physik. Chem. 28, 520, '99.)

Millimols per Liter.		Grams per Liter of Saturated Solution.		
NH_4Cl.	$Ca(OH)_2$.	NH_4Cl.	$Ca(OH)_2$ =	CaO.
0.00	20.22	0.00	1.50	1.13
21.76	29.08	1.165	2.16	1.63
43.52	39.23	2.330	2.91	2.20
83.07	59.68	4.447	4.42	3.45

Solubility of Calcium Hydroxide in Aqueous Solutions of Calcium Chloride.

(Zahorsky — Z. anorg. Chem. 3, 41, '93; Lunge — J. Soc. Chem. Ind. 11, 882, '92.)

Concentration of $CaCl_2$ Solutions, Wt. %.	Grams CaO Dissolved per 100 cc. Solvent at: 20°.	40°.	60°.	80°.	100°.
0	0.1374	0.1162	0.1026	0.0845	0.0664
5	0.1370	0.1160	0.1020	0.0936	0.0906
10	0.1661	0.1419	0.1313	0.1328	0.1389
15	0.1993	0.1781	0.1706	0.1736	0.1842
20	0.1857*	0.2249	0.2204	0.2295	0.2325
25	0.1661*	0.3020*	0.2989	0.3261	0.3710
30	0.1630*	0.3680*	0.3664	0.4122	0.4922

* Indicates cases in which a precipitate of calcium oxychloride separated and thus removed some of the $CaCl_2$ from solution.

The results in 0% $CaCl_2$ solutions, *i.e.*, in pure water, are high when compared with the average results given above.

Solubility of Calcium Hydroxide in Aqueous Solutions of Calcium Chloride at 25°.

(Schreinemakers and Figee, 1911.)

Gms. per 100 Gms. Sat. Sol. $CaCl_2$.	CaO.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. $CaCl_2$.	CaO.	Solid Phase.
5.02	0.101	$Ca(OH)_2$	33.21	0.245	$CaCl_2.4CaO.14H_2O$
10	0.115	"	33.72	0.254	" + $CaCl_2.CaO.2H_2O$
15.14	0.140	"	34.36	0.173	$CaCl_2.CaO.2H_2O$
18.15	0.148	" + $CaCl_2.4CaO.14H_2O$	38.61	0.060	"
18.01	0.152	$CaCl_2.4CaO.14H_2O$	41.32	0.048	"
21.02	0.147	"	44.30	0.030	"
28.37	0.170	"	44.61	0.029	" + $CaCl_2.6H_2O$
32.67	0.225	$Ca(OH)_2$?	44.77	...	$CaCl_2.6H_2O$

Data for the above system at 10°, 25°, 40°, 45°, 48°, and 50° are given by Milikau (1916).

Data for the solubility of calcium hydroxide in aqueous calcium iodide solutions at 25° are also given by Milikau.

Solubility of Calcium Hydroxide in Aqueous Solutions of Calcium Nitrate at 25° and at 100°.

(Bassett and Taylor, 1914; see also Cameron and Robinson, 1907a)

Results at 25°.			Results at 100°.			Results at 100° (Con.).		
Gms. per 100 Gms. Sat. Sol		Solid Phase.	Gms. per 100 Gms. Sat Sol.		Solid Phase.	Gms. per 100 Gms. Sat Sol.		Solid Phase.
CaO.	$Ca(NO_3)_2$.		CaO.	$Ca(NO_3)_2$.		CaO.	$Ca(NO_3)_2$.	
0.1150	0	$Ca(OH)_2$	0.0561	0	$Ca(OH)_2$	1.576	58.67	$Ca_2N_2O_7.2H_2O$
0.0978	4.836	"	0.0550	2.42	"	1.348	60.44	"
0.1074	9.36	"	0.0624	4.91	"	1.167	62.82	"
0.1193	13.77	"	0.1110	15.39	"	1.077	66.44	"
0.1444	22.46	"	0.1200	16.10	"	1.141	69.12	"
0.1650	27.83	"	0.155	21.86	"			
0.1931	32.94	"	0.269	33.03	"	1.252	70.60	" + a very little $Ca_2N_2O_7.\frac{1}{2}H_2O$
0.2579	40.66	"	0.480	42.26	"			
0.3060	44.44	"	0.973	50.94	"	1.203	70.40	$Ca_2N_2O_7.\frac{1}{2}H_2O$
0.2802	45.28	$Ca_2N_2O_7.3H_2O$	1.261	53.75	"	1.103	71.44	"
0.2314	47.79	"	1.477	55.40	"	0.937	73.85	"
0.1894	51.07	"	1.476	55.43	"	0.849	75.74	"
0.1659	53.20	"	1.491	55.65	"	0.815	76.94	"
0.1486	55.25	"	1.635	56.89	" $+Ca_2N_2O_7.2H_2O$	0.804	77.62	$Ca(NO_3)_2$
0.0836	57.72	$Ca(NO_3)_2.4H_2O$	1.686	57.03		0.412	77.74	"
0	57.98	"	1.596	57.91	$Ca_2N_2O_7.2H_2O$	0	78.43	"

Cerasine wax bottles were used and more than 6 months constant agitation allowed for attainment of equilibrium at 25° and 4–14 days at 100°.

Solubility of Calcium Hydroxide in Aqueous Solutions of Calcium Sulfate at 25°.

(Cameron and Bell, 1906)

Gms. per 100 cc Sat. Sol.		Solid Phase.	Gms per 100 cc. Sat. Sol.		Solid Phase.
$CaSO_4$.	CaO.		$CaSO_4$.	CaO	
0	0.1166	$Ca(OH)_2$	0.1634	0.0939	$CaSO_4.2H_2O$
0.0391	0.1141	"	0.1722	0.0611	"
0.0666	0.1150	"	0.1853	0.0349	"
0.0955	0.1215	"	0.1918	0.0176	"
0.1214	0.1242	"	0.2030	0.0062	"
0.1588	0.1222	" $+CaSO_4.2H_2O$	0.2126	0	"

The mixtures were constantly agitated at 25° for two weeks.

Solubility of Calcium Hydroxide in Aqueous Solutions of Potassium Chloride and of Sodium Chloride.

(Cabot, 1897)

Gms. of the Chloride per Liter.	In KCl Solutions. Gms. CaO per Liter at: 0°.	15°.	99°.	In NaCl Solutions. Gms. CaO per Liter at: 0°.	15°.	99°.
0	1.36	1.31	0.635	1.36	1.31	0.635
30	1.701	1.658	0.788	1.813	1.703	0.969
60	1.725	1.674	0.876	...	1.824	1.004
120	1.718	1.606	0.894	1.86	1.722	1.015
240	1.248	1.199	0.617	1.37	1.274	0.771
320	...	...	...	1.054	0.929	0.583

Results in harmony with the above for the solubility of calcium hydroxide in aqueous solutions of potassium chloride at 50°, are given by Kernot, d'Agostino and Pellegrino (1908).

SOLUBILITY OF LIME IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE ALONE AND CONTAINING SODIUM HYDROXIDE.

(Maigret, 1905.)

G. NaCl per Liter.	Gms. CaO per Liter of Solution. Without NaOH.	0.89 NaOH per Liter.	4.09 NaOH per Liter.	G. NaCl. per Liter.	Gms. CaO per Liter of Solution. Without NaOH.	0.89 NaOH per Liter.	4.09 NaOH per Liter.
0	1.3	0.8	0.22	150	1.65	1.25	0.44
5	1.4	0.9	...	175	1.6	1.2	...
10	1.6	1.0	...	182	1.6	1.2	...
25	1.7	1.1	...	225	1.4	1.0	...
50	1.8	1.25	...	250	1.3	0.9	...
75	1.9	1.4	0.55	300	1.1	0.7	0.22
100	1.85	1.4	...	...	...	...	...

SOLUBILITY OF CALCIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE.

(d'Anselme — Bull. soc. chim. [3] 29, 938, '03.)

Concentration of NaOH: Normality.	Gms. per Liter	Grams CaO per Liter Sat. Solution at: 20°.	50°.	70°.	100°.
0	0	1.170	0.880	0.75	0.54
N/100	0.4	0.94	0.65	0.53	0.35
N/25	1.6	0.57	0.35	0.225	0.14
N/15	2.66	0.39	0.20	0.11	0.05
N/8	5.00	0.18	0.06	0.04	0.01
N/5	8.00	0.11	0.02	0.01	trace
N/2	20.00	0.02	trace	0.00	0.00

For results upon mixtures of calcium hydroxide and alkali carbonates and hydroxides, see Bodländer — Z. angew. Chem. **18**, 1138, '05.

SOLUBILITY OF CALCIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF GLYCEROL AT 25°.

(Herz and Knoch — Z. anorg. Chem. 46, 193, '05, for older determinations, see Berthelot — Ann. chim phys. [3] 46, 176; and Carles — Arch. Pharm. [3] 4, 558, '74.)

Density of Solutions	Wt. per cent Glycerine in Solution.	Millimols $\frac{1}{2}Ca(OH)_2$ per 100 cc. Solution.	Gms. per 100 cc. Solution. $Ca(OH)_2$	= CaO.
1.0003	0.0	4.3	0.1593	0.1206
1.0244	7.15	8.13	0.3013	0.2281
1.0537	20.44	14.9	0.5522	0.4180
1.0842	31.55	22.5	0.8339	0.6313
1.1137	40.95	40.1	1.486	1.125
1.1356	48.7	44.0	1.631	1.234
1.2072	69.2	95.8	3.550	2.687

Data for the solubility of calcium hydroxide in aqueous solutions of phenol at 25° are given by van Meurs (1916).

Solubility of Calcium Hydroxide in Aqueous Solutions of Glycerol and of Cane Sugar at 25°.

(Cameron and Patten, 1911.)

In order to obviate the uncertainties due to the presence of a large excess of the solid phase in contact with the solutions, the clear liquids, saturated at 0°, were decanted from the solid and slowly brought to 25° and constantly agitated at this temperature, until equilibrium with the finely divided solid phase, which separates at the higher temperature, was reached.

Results for Glycerol Solutions.

d_{25} of Sat. Sol.	Gms per 100 Gms. Sat Sol. $Ca(OH)_2$.	Gms per 100 Gms. Sat Sol. $C_3H_5(OH)_3$.	Solid Phase.
0.983	0.117	0	$Ca(OH)_2$
1.008	0.178	3.50	"
...	0.413	15.59	"
1.042	0.48	17.84	"
1.088	0.88	34.32	"
1.149	1.34	55.04	"

Results for Sugar Solutions.

d_{25} of Sat. Sol.	Gms per 100 Gms Sat Sol $Ca(OH)_2$.	Gms per 100 Gms Sat Sol $C_{12}H_{22}O_{11}$	Solid Phase.
1	0.188	0.62	$Ca(OH)_2$ + Sugar
1.021	0.730	4.82	"
1.037	1.355	7.50	"
1.067	3.21	11.90	"
1.109	5.38	17.42	"
1.123	6.07	19.86	"

Solubility of Calcium Hydroxide in Aqueous Solutions of Cane Sugar at 80°.

(von Ginneken, 1911.)

Gms per 100 Gms. Sat Sol. CaO.	Gms per 100 Gms. Sat Sol. Sugar.	Solid Phase.	Gms. per 100 Gms Sat Sol. CaO.	Gms. per 100 Gms Sat Sol. Sugar	Solid Phase.
0.117	4.90	$Ca(OH)_2$	0.358	19.50	$Ca(OH)_2$
0.189	9.90	"	0.548	24.60	"
0.230	14.75	"	1.017	29.70	"

Solubility of Lime in Aqueous Solutions of Sugar.

(Weisberg — Bull. soc. chim. [3] 21, 775, '99.)

The original results were plotted on cross-section paper and the following table constructed from the curves.

1st series, t° = 16'–17°. 2d, series t° = 15°.

Gms. per 100 Gms. Solution. Sugar.	Gms. per 100 Gms. Solution. CaO.	G. CaO per 100 Gms. Sugar in Sol.	Gms. per 100 Gms. Solution. Sugar.	Gms. per 100 Gms. Solution. CaO.	G. CaO per 100 Gms. Sugar in Sol.
1	0.30	35.0	1	0.50	62.5
2	0.56	28.7	2	0.75	36.0
3	0.85	28.0	3	1.02	32.5
4	1.12	27.7	4	1.22	30.2
5	1.40	27.5	5	1.45	28.5
6	1.65	27.5	6	1.67	27.7
8	2.22	27.5	8	2.22	27.5
10	2.77	27.5	10	2.77	27.5
12	3.27	27.5	12	3.27	27.5
14	3.85	27.5	14	3.85	27.5

In the second series a very much larger excess of lime was used than in the first series. The author gives results in a subsequent paper, — Bull. soc. chim. [3] **23**, 740, '00, — which show that the solubility is also affected by the condition of the calcium compound used, *i.e.*, whether the oxide, hydrate, or milk of lime is added to the sugar solutions.

A very exhaustive investigation of the factors which influence the solubility of lime in sugar solutions is described by Claasen (1911).

CALCIUM IODATE $Ca(IO_3)_2.6H_2O$.

SOLUBILITY IN WATER.

(Mylius and Funk — Ber. 30, 1724, '97; W. Abh. p. t. Reichanstalt 3, 448, '00.)

t°.	Gms. $Ca(IO_3)_2$ per 100 Gms. Sol.	Mols. $Ca(IO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Ca(IO_3)_2$ per 100 Gms. Sol.	Mols. $Ca(IO_3)_2$ per 100 Mols. H_2O.	Solid Phase.
0	0.10	0.0044	$Ca(IO_3)_2.6H_2O$	21	0.37	0.016	$Ca(IO_3)_2.H_2O$
10	0.17	0.0075	"	35	0.48	0.021	"
18	0.25	0.011	"	40	0.52	0.023	"
30	0.42	0.019	"	45	0.54	0.024	"
40	0.61	0.027	"	50	0.59	0.026	"
50	0.89	0.040	"	60	0.65	0.029	"
54	1.04	0.046	"	80	0.79	0.034	"
60	1.36	0.063	"	100	0.94	0.042	"

Density of solution saturated at 18° = 1.00.

CALCIUM IODIDE CaI_2.

SOLUBILITY IN WATER.

(Average curve from the results of Kremers — Pogg. Ann. 103, 65, '58; Etard — Ann. chim. phys. [7] 2, 532, '94)

t°.	Gms. CaI_2 per 100 Gms. Solution.	t°.	Gms. CaI_2 per 100 Gms. Solution.	t°.	Gms. CaI_2 per 100 Gms. Solution.
0	64.6	30	69	80	78
10	66.0	40	70.8	100	81
20	67.6	60	74		

Density of solution saturated at 20° = 2.125.

The fusion-point curve (solubility, see footnote, p. 1) is given for mixtures of calcium iodide and iodine by Olivari (1908).

CALCIUM IODO MERCURATE.

A saturated solution of CaI_2 and HgI_2 in water at 15.9° was found by Duboin (1906) to have the composition $CaI_2.1.3HgI_2.12.3H_2O$; d = 2.89 and the solid phase in contact with the solution was $CaI_2.HgI_2.8H_2O$.

CALCIUM PerIODIDE CaI_4

Data for the formation of calcium periodide in aqueous solution at 25° are given by Herz and Bulla (1911). (See reference note under calcium perbromide, p. 189.)

CALCIUM LACTATE $Ca(C_6H_{10}O_6).5H_2O$.

100 gms. H_2O dissolve 3.1 gms. of the salt at 0°, 5.4 gms. at 15° and 7.9 gms. at 30°. (Hill and Cocking, 1912.)

CALCIUM MALATE $CaC_4H_4O_5.H_2O$.

SOLUBILITY OF CALCIUM MALATE IN WATER AND IN ALCOHOL.

(Partheil and Hübner, 1903)

100 gms. H_2O dissolve 0.9214 gm. $CaC_4H_4O_5.H_2O$ at 18°, and 0.8552 gm. at 25°.

100 gms. 95% alcohol dissolve 0.0049 gm. $CaC_4H_4O_5.H_2O$ at 18°, and 0.00586 gm. at 25°.

CALCIUM (Neutral) MALATE $Ca(C_4H_4O_5).3H_2O$.

CALCIUM (Acid) MALATE $Ca(C_4H_5O_5)_2.6H_2O$.

CALCIUM MALONATE $Ca(C_3H_2O_4).4H_2O$.

SOLUBILITY OF EACH IN WATER.

(Iwig and Hecht, 1886; Cantoni and Basadonna, 1906; the malonate, Miczynski, 1886)

t°.	Ca. Neutral Malate. Gms. $Ca(C_4H_4O_5)$ per 100 Gms. H_2O.	Gms. Sol.	cc. Sol. (C and B).	Ca. Acid Malate. Gms. $Ca(C_4H_5O_5)_2$ per 100 Gms. Water.	Solution.	Ca. Malonate. Gms. $Ca(C_3H_2O_4)$ per 100 Gms. H_2O.
0	...	...	...	...	...	0.290 (0.374)
10	0.85	0.84	...	1.8	1.77	0.330 (0.419)
20	0.82	0.81	0 907	1.5	1 48	0.365 (0 460)
30	0.78	0.77	0.835	2	1.96	0.396 (0.495)
40	0.74	0.73	0.816	5.2	4.94	0.422 (0 524)
50	0.66	0.65	0.809	15	13.09	0.443 (0 544)
57	0.57	0.56	...	32.24	24.29	...
60	0.58	0.58	0 804	26	20.64	0.460
70	0 63	0 63	0.795	11	9 91	0 472
80	0 71	0.70	0.754	6.8	6.37	0.479
90	...	...	0.740			

The results for calcium malonate given above in parentheses are by Cantoni and Diotalevi (1905), but these authors fail to state the terms in which their data are reported. By comparison with other papers of the series, it is probable that in this case the figures refer to grams per 100 cc. saturated solution.

CALCIUM NITRATE $Ca(NO_3)_2.4H_2O$.

SOLUBILITY IN WATER.

(Bassett and Taylor, 1912)

(Silica vessels used. Constant agitation at constant temperature for two to three days. Calcium determined by precipitation as oxalate and weighing as oxide.)

t°.	Gms $Ca(NO_3)_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms $Ca(NO_3)_2$ per 100 Gms. Sat Sol.	Solid Phase.	t°.	Gms. $Ca(NO_3)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
− 0.4	1.4	Ice	10	53.55	$Ca(NO_3)_2.4H_2O$	45	71 45	$Ca(NO_3)_2.3H_2O$
− 1 4	4 78	"	15	54 94	"	50	73.79	"
− 1.9	6.53	"	20	56 39	"	51	74.73	"
− 3 05	10	"	25	57 98	"	51.1	...†	"
− 4.15	12.98	"	30	60.41	"	49	77.49	$Ca(NO_3)_2.2H_2O$
−15.7	33.13	"	35	62 88	"	51	78.05	"
−21.7	38.7	"	40	66.21	"	55	78.16	$Ca(NO_3)_2$
−28.7	...*		42.4	68 68	"	80	78.2	"
−26.7	43 37	$Ca(NO_3)_2.4H_2O$	42.4	68.74	"	100	78 43	"
−10	47.31	"	42.7	...†	"	125	78 57	"
0	50.50	"	42.45	71.7	"	147.5	78.8	"
5	51.97	"	40	70.37	$Ca(NO_3)_2.3H_2O$	151	79	"

† m. pt. * Eutectic.

SOLUBILITY OF THE UNSTABLE CALCIUM NITRATE TETRAHYDRATE β IN WATER.

(Results supplementary to the above.)

(Taylor and Henderson, 1915.)

t°.	Gms. $Ca(NO_3)_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms $Ca(NO_3)_2$ per 100 Gms. Sat Sol.	Solid Phase.
0	50.17	$\alpha Ca(NO_3)_2.4H_2O$	38	66.65	$\beta Ca(NO_3)_2.4H_2O$
22.2	56.88	"	39	67.93	"
25	57.90	"	39 6 (m. pt.)	69.50	"
30	60.16	"	39 (reflex pt.)	75.34	"
30	61.57	$\beta Ca(NO_3)_2.4H_2O$	40	66.22	$\alpha Ca(NO_3)_2.4H_2O$
34	63.66	"	42.7 (m. pt.)	69.50	"
35	62.88	$\alpha Ca(NO_3)_2.4H_2O$	42.4 (reflex pt.)	71.70	"
38	64.34	"	25	77.30	$Ca(NO_3)_2$

SOLUBILITY OF CALCIUM NITRATE IN AQUEOUS SOLUTIONS OF CALCIUM THIOSULFATE AT 9° AND AT 25° AND VICE VERSA.
(Kremann and Rodemund, 1914.)

Results at 9°.			Results at 25°.		
Gms. per 100 Gms Sat. Sol.		Solid Phase.	Gms per 100 Gms. Sat. Sol.		Solid Phase.
$Ca(NO_3)_2$.	CaS_2O_3.		$Ca(NO_3)_2$.	CaS_2O_3.	
46.02	5.46	$Ca(NO_3)_2.4H_2O$	54.03	4.27	$Ca(NO_3)_2.4H_2O$
45.68	6.81	" $+CaS_2O_3.6H_2O$	50.25	9.10	"
27.92	10.46	$CaS_2O_3.6H_2O$	45.92	13	" $+CaS_2O_3.6H_2O$
10.49	22.81	"	42.93	13.83	$CaS_2O_3.6H_2O$
...	29.33	"	32.01	17.09	"
			19.51	23.78	"
			8.15	29.85	"

SOLUBILITY OF CALCIUM NITRATE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AT 9° AND AT 25° AND VICE VERSA.
(Kremann and Rodemund, 1914)

Results at 9°.			Results at 25°.		
Gms. per 100 Gms Sat. Sol.		Solid Phase.	Gms. per 100 Gms Sat Sol.		Solid Phase.
$Ca(NO_3)_2$.	$NaNO_3$		$Ca(NO_3)_2$.	$NaNO_3$.	
47.51	9.51	$Ca(NO_3)_2.4H_2O$	54.58	7.25	$Ca(NO_3)_2.4H_2O$
46.08	12.56	" $+NaNO_3$	53.22	10.70	"
26.67	23.32	$NaNO_3$	52.73	12.08	" $+NaNO_3$
11.76	34.26	"	52.40	11.88	$NaNO_3$
			37.31	19.48	"
			26.91	24.98	"
			14.61	36.12	"

These authors also give the complete solubility relations of the reciprocal salt pairs, $Ca(NO_3)_2 + Na_2S_2O_3 \leftrightarrows 2NaNO_3 + CaS_2O_3$ at 9° and 25°.

SOLUBILITY OF CALCIUM NITRATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 25°.
(Bassett and Taylor, 1912)

(The mixtures were shaken intermittently, by hand, during quite long periods; one week was allowed between duplicate determinations.)

Gms. per 100 Gms. Sat Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol		Solid Phase.	Gms. per 100 Gms. Sat Sol		Solid Phase.
$Ca(NO_3)_2$.	HNO_3		$Ca(NO_3)_2$.	HNO_3		$Ca(NO_3)_2$.	HNO_3.	
57.98	0	$Ca(NO_3)_2.4H_2O$	32 84	32.63	$Ca(NO_3)_2.4H_2O$	9 34	65.69	$Ca(NO_3)_2.2H_2O$
54 82	3.33	"	32.50	33 52	"	8 52	67.20	"
52.96	5.87	"	33 44	35 63	$Ca(NO_3)_2.3H_2O$	5 06	71.12	$Ca(NO_3)_2$
51 58	7 21	"	29 05	41 66	"	2.53	74.77	"
47.82	11.27	"	27 79	45.70	"	1 05	78 56	"
45.59	13.71	"	31 09	40.56	$Ca(NO_3)_2.2H_2O$	0.54	80.83	"
40.70	19.65	"	26 07	45 70	"	0 36	85.83	"
38.17	22.80	"	17 41	55 48	"	0 01	90.90	"
34.46	28.81	"	12.25	62.05	"	0	96.86	"

Freezing-point data for the Ternary System $Ca(NO_3)_2 + KNO_3 + NaNO_3$ are given by Menzies and Dutt, 1911.

SOLUBILITY OF CALCIUM NITRATE IN SEVERAL ORGANIC SOLVENTS.

Solvent.	t°.	Gms. $Ca(NO_3)_2$ per 100 Gms. Sat. Solution.	Authority.
Methyl Alcohol	25	65.5	(D'Ans and Siegler, 1913.)
Propyl "	25	36.5	" "
i Butyl "	25	25	" "
Amyl "	25	13.3	" "
Acetone	25	58.5	" "
Methyl Acetate	18	41 (*d* sat. sol. = 1.313)	(Naumann, 1909.)

SOLUBILITY OF CALCIUM NITRATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°. (D'Ans and Siegler, 1913)

Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	$Ca(NO_3)_2$	Solid Phase.	Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	$Ca(NO_3)_2$.	Solid Phase.
0	57.5	$Ca(NO_3)_2.4H_2O$	15.2	69.52	$Ca(NO_3)_2$ unstable
8.1	55.2	"	20.4	66.08	" "
14.1	52.9	"	35.9	57.7	" "
22.3	50.2	"	41.8	51.4	" "
29.4	49	"	27.39	61.96	$Ca(NO_3)_2$ stable
31.2	52	"	28.5	61.15	"
29.5	56.2	"	29.6	60.3	" $+Ca(NO_3)_2.2C_2H_5OH$
27.8	60	"	60.2	38.6	$Ca(NO_3)_2.2C_2H_5OH$
26.5	62.3	" $+Ca(NO_3)_2$	54.6	41.9	"
0	82.5	$Ca(NO_3)_2$ unstable	42.5	50.97	"
5.8	77	" "	35.8	55.3	"

CALCIUM NITRITE $Ca(NO_2)_2.4H_2O$.

SOLUBILITY IN WATER. (Oswald, 1914)

t°.	Gms $Ca(NO_2)_2$ per 100 Gms Sat. Sol.	Solid Phase.	t°.	Gms $Ca(NO_2)_2$ per 100 Gms Sat. Sol.	Solid Phase.
− 4	16.7	Ice	18.5	43	$Ca(NO_2)_2.4H_2O$
− 9.3	25.5	"	42	51.8	"
−12.5	29.5	"	44	53.5	" $+Ca(NO_2)_2.2H_2O$
−14.5	32	"	54	55.2	$Ca(NO_2)_2.2H_2O$
−17.5	35	" $+Ca(NO_2)_2.4H_2O$	64	58.4	"
− 9.5	36.2	$Ca(NO_2)_2.4H_2O$	70	60.3	"
0	38.3	"	73	61.5	"
16	42.3 ($d_{16}=1.4205$)	"	91	71.2	"

An aqueous solution simultaneously saturated with calcium nitrite and silver nitrite, contains 92.4 gms. $Ca(NO_2)_2$ + 11.2 gms. $AgNO_2$ per 100 gms. H_2O at 14°. (Oswald, 1914)

100 cc. sat. solution of calcium nitrite in 90 % alcohol contain 39 gms. $Ca(NO_2)_2.H_2O$ at 20°.

100 cc. sat. solution of calcium nitrite in absolute alcohol contain 1.1 gms. $Ca(NO_2)_2.H_2O$ at 20°. (Vogel, 1903)

CALCIUM OLEATE $(C_{18}H_{33}O_2)Ca$.

One liter water dissolves about 0.1 gm. calcium oleate at t° not stated. (Fahrion, 1916)
100 gms. glycerol (of $d = 1.114$) dissolve 1.18 gms. calciumoleate at t° not stated. (Asselin, 1873.)

CALCIUM OXALATE $Ca(COO)_2.H_2O$.

SOLUBILITY IN WATER, BY ELECTROLYTIC CONDUCTIVITY METHOD. (Holleman, Kohlrausch, and Rose, 1893; Richards, McCaffrey, and Bisbee, 1901.)

t°.	Gms. CaC_2O_4 per Liter of Solution.	t°.	Gms. CaC_2O_4 per Liter of Solution.
13	0.0067 (H)	25	0.0068 (R, McC and B)
18	0.0056 (K and R)	50	0.0095 "
24	0.0080 (H)	95	0.0140 "

SOLUBILITY OF CALCIUM OXALATE IN AQUEOUS SOLUTIONS OF ACETIC ACID AT 26°–27°. (Herz and Muhs, 1903)

Normality of Acetic Acid.	G. CH_3COOH per 100 cc. Sol.	Residue from 50.052 cc. Solution.
0	0.00	0.0017
0.58	3.48	0.0048
2.89	17.34	0.0058
5.79	34.74	0.0064

The residues were dried at 70° C.

SOLUBILITY OF CALCIUM OXALATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 25°.

(Henderson and Taylor, 1916.)

Normality of HCl.	Gms. CaC_2O_4 per Liter Sat. Sol.	Normality of HCl.	Gms. CaC_2O_4 per Liter Sat. Sol.
0	0.009	0.500	2.638
0.125	0.717	0.625	3.319
0.250	1.359	0.750	3.922
0.375	2.019	1	5.210

These authors also give data showing the effect of increasing amounts of KCl and KNO_3 upon the solubility of calcium oxalate in 0.5 normal HCl at 25°, and also of the effect of increasing amounts of potassium trichloracetic acid upon the solubility in 0.5 normal trichloracetic acid, and of increasing amounts of potassium monochloracetic acid upon the solubility of calcium oxalate in 0.5 normal monochloracetic acid.

SOLUBILITY OF CALCIUM OXALATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AND OF SODIUM PHOSPHATE.

(Gerard, 1901.)

Salt in Aq. Solution.	Gms. Salt per Liter.	t°.	Gms. CaC_2O_4 per Liter.	Salt in Aq. Solution.	Gms. Salt per Liter.	t°.	Gms. CaC_2O_4 per Liter.
NaCl	1	25	0.0075	NaCl	25	37	0.0414
"	5	25	0.0188	$Na_2H(PO_4)_2$	4.8	15	0.016
"	10	25	0.0255	"	4.8	37	0.033
"	25	25	0.0291				

One liter 45% ethyl alcohol dissolves 0.000525 gm. calcium oxalate, temp. not stated. (Gueiin, 1912.)

CALCIUM OXIDE CaO.

100 gms. molten $CaCl_2$ dissolve 16.2 gm. CaO at about 910°. (Arndt and Loewenstein, 1909.)

Data for the systems, CaO + MgO and for CaO + Al_2O_3 + MgO are given by Rankin and Merwin (1916); for CaO + Al_2O_3 + SiO_2 by Rankin and Wright (1915); for CaO + Fe_2O_3 by Sosman and Merwin (1916); and for CaO + MgO + SiO_2 by Bowen (1914).

Data for the system CaO + C + CaC_2 + CO are given by Thompson (1910).

CALCIUM PHOSPHATE (Tribasic) $Ca_3(PO_4)_2$.

SOLUBILITY IN WATER.

The determinations of the solubility of this salt in water, as stated in the literature, are found to vary within rather wide limits, due, no doubt, to the fact that so-called tribasic calcium phosphate is apparently a solid solution of the dibasic salt and calcium oxide, and therefore analyses of individual samples may show an excess of either lime or phosphoric acid. When placed in contact with water, more PO_4 ions enter solution than Ca ions, the resulting solution being acid in reaction and the solid phase richer in lime than it was, previous to being added to the water. For material having a composition approximating closely that represented by the formula $Ca_3(PO_4)_2$ the amount which is dissolved by CO_2 free water at the ordinary temperature, as calculated from the calcium determination, is 0.01 to 0.10 gram per liter, depending upon the conditions of the experiment. Water saturated with CO_2 dissolves 0.15 to 0.30 gram per liter.

A list of references to papers on this subject is given by Cameron and Hurst — J. Am. Chem. Soc., **26**, 903, 1904; see also Cameron and Bell, *Ibid.*, **27**, 1512, 1905.

CALCIUM PHOSPHATE (Dibasic) $CaHPO_4.2H_2O$.

SOLUBILITY IN WATER.

(Cameron and Seidell — J. Am. Chem. Soc. 26, 1460, '04; see also Rindell — Compt. rend. 134, 112, '02; Magnanini — Gazz. chim. ital. 31, II, 544, '01.)

1 liter of CO_2 free water dissolves 0.136 gram $CaHPO_4$ at 25°.
1 liter of water sat. with CO_2 dissolves 0.561 gram $CaHPO_4$ at 25°.

SOLUBILITY OF DI CALCIUM PHOSPHATE AND OF MONO CALCIUM PHOSPHATE IN AQUEOUS SOLUTIONS OF PHOSPHORIC ACID AT 25°.

(Cameron and Seidell — J. Am. Chem. Soc. 27, 1508, '05; Causse — Compt. rend. 114, 414, '92.)

Grams per Liter of Solution. CaO.	Grams per Liter of Solution. P_2O_5.	Gms. per Liter Calc. from CaO Found.		P_2O_5 per Liter in Excess of that combined with Ca.	Solid Phase.
1.71	4.69	4.15	$CaHPO_4$	2.53	$CaHPO_4.2H_2O$
11.57	36.14	28.05	"	21.5	"
23.31	75.95	56.53	"	46.45	"
39.81	139.6	97.01	"	89.0	"
49.76	191.0	120.7	"	128.0	"
59.40	234.6	144.1	"	159.4	"
70.31	279.7	170.6	"	190.7	"
77.00	317.0	174.2	$CaHPO_4$ or	226.0	$CaHPO_4.2H_2O$+
		321.3	$CaH_4(PO_4)_2$	122.2	$CaH_4(PO_4)_2.H_2O$
72.30	351.9	301.6	$CaH_4(PO_4)_2$	169.0	$CaH_4(PO_4)_2.H_2O$
69.33	361.1	289.3	"	186.1	"
59.98	419.7	250.2	"	267.9	"
53.59	451.7	223.7	"	316.1	"
44.52	505.8	185.8	"	393.1	"
39.89	538.3	166.4	"	437.4	"

Density of the solution in contact with both salts at 25° = 1.29.

SOLUBILITY OF CALCIUM PHOSPHATES IN AQUEOUS SOLUTIONS OF PHOSPHORIC ACID AT DIFFERENT TEMPERATURES.

(Bassett, Jr., 1908, 1917.)

Results at 25°. Gms per 100 Gms. Sat Sol. CaO.	P_2O_5.	Solid Phase.	Results at 40°. Gms. per 100 Gms. Sat Sol CaO.	P_2O_5.	Solid Phase.	Results at 50.7°. Gms. per 100 Gms. Sat Sol. CaO.	P_2O_5.	Solid Phase.
3.088	36.11	$CaH_4P_2O_8.H_2O$	1.768	42.42	$CaH_4P_2O_8.H_2O$	0.336	62.01	$CaH_4P_2O_8$+ $CaH_4P_2O_8.H_2O$
4.908	28.34	"	3.584	36.79	"			
5.809	24.20	" +$CaHPO_4$	5.755	27.25	" +$CaHPO_4$	0.635	58.08	$CaH_4P_2O_8.H_2O$
5.523	22.90	$CaHPO_4$	4.813	21.67	$CaHPO_4$	1.428	50.25	"
4.499	17.55	"	3.810	16.35	"	2.974	41.92	"
2.638	9.100	"	2.536	9.905	"	4.880	33.18	"
1.878	6.049	"	1.847	6.979	"	5.725	29.61	" +$CaHPO_4$
0.826	2.387	"	1.267	4.397	"	3.507	15.48	$CaHPO_4$
0.165	0.417	" $CaHPO_4.2H_2O$	0.576	1.819	"	2.328	9.465	"
0.07	0.166		0.156	0.426	"	1.563	6.157	"
0.06	0.140	"	0.0592	0.158	"	0.692	2.281	"
0.05	0.118	"	0.0508	0.128	$Ca_3P_2O_8.H_2O$	0.0596	0.1527	$CaHPO_4.2H_2O$
0.04	0.093	"	0.0098	0.0262	"	0.0514	0.1331	$Ca_3P_2O_8.H_2O$
0.03	0.070	More basic than $CaHPO_4.2H_2O$	0.0709	trace	$Ca_4P_2O_9.4H_2O$	0.0351	0.0942	"
0.02	0.047		0.0814	"	"	0.0106	0.0309	"
0.01	0.023		0.0840	"	"	0.0007	0.0007	"

In the case of most of the solutions 7–15 weeks constant agitation was allowed for attainment of equilibrium. For the last seven results at 25°, 18 months were required. Cerasine bottles were used in these cases. The solid phases were determined by analysis. The quintuple points were found by dilatometer experiments at 36°, 21° and 152°. (See next page.)

SOLUBILITY OF CALCIUM PHOSPHATES IN AQUEOUS SOLUTIONS OF PHOSPHORIC ACID AT TEMPERATURES ABOVE 100°.

(Bassett, Jr., 1908.)

t°.	Gms. per 100 Gms Sat. Sol. CaO.	P_2O_5.	Solid Phase.
100	2.503	53.71	$CaH_4P_2O_8+CaH_4P_2O_8.H_2O$
115 b. pt.	5.623	43.60	$CaH_4P_2O_8.H_2O+CaHPO_4$
132 "	4.327	53.43	$CaH_4P_2O_8+CaH_4P_2O_8.H_2O$
169 "	4.489	63.95	$CaH_4P_2O_8$

The quintuple points for the system determined by dilatometer experiments are as follows:

152	5.60	53	$CaH_4P_2O_8+CaH_4P_2O_8H_2O+CaHPO_4$
21	5.81	23.5	$CaH_4P_2O_8.H_2O+CaHPO_4+CaHPO_4.2H_2O$
36	0.0514	0.14	$CaHPO_4+CaHPO_4.2H_2O+Ca_3P_2O_8.H_2O$

For additional data on the solubility of calcium phosphates in water, see Cameron and Bell, 1905 and 1910.

Data for the four component system, lime, phosphoric acid, sulfuric acid and water, the essential constituents of "superphosphates," are given by Cameron and Bell (1906).

One liter of aqueous 0.005 *n* potassium bitartrate solution sat. with calcium phosphate, contains 0.08 gm. Ca and 0.181 gm. H_3PO_4 at 25°. (Magnanini, 1901.)

SOLUBILITY OF CALCIUM PHOSPHATE IN AQUEOUS SALT SOLUTIONS UNDER 2 ATMOSPHERES PRESSURE OF CO_2 AT 14°.

(Ehlert and Hempel, 1912)

Salt in Aq. Solvent.	Gms. Salt per 100 Gms. H_2O.	Gms. $Ca_3(PO_4)_2$ per Liter Solvent.	Salt in Aq. Solution.	Gms. Salt per 100 Gms H_2O.	Gms. $Ca_3(PO_4)_2$ per Liter Solvent.
Water	...	0.228	$MgSO_4.K_2SO_4.MgCl_2.6H_2O$	70.95	1.777
NH_4Cl	45.74	1.371	"	conc.	2.491
"	conc.	1.293	K_2SO_4	74.5	4.904
$(NH_4)_2SO_4$	56.5	2.413	"	conc.	4.765
"	conc.	5.885	NaCl	50	1 321
$MgCl_2.6H_2O$	86.9	1.287	"	conc.	0.641
"	conc.	2.892	$NaNO_3$	72.7	1.583
$MgSO_4.7H_2O$	105.3	1.9728	"	Conc.	0.864
"	conc.	3.6001	$Na_2SO_4.10H_2O$	137.7	2.491
$MgCl_2.KCl.6H_2O$	79.2	1.577	"	conc.	3.227
"	conc.	1.154			

Data for the solubility of calcium phosphate in aqueous saturated solutions of carbon dioxide containing ammonia are given by Foster and Neville, 1910.

CALCIUM PELARGONATE (Nonate) $Ca[CH_3(CH_2)_7COO]_2.H_2O$.

CALCIUM PROPIONATE $Ca(CH_3.CH_2COO)_2.H_2O$.

SOLUBILITY OF EACH IN WATER.

(Lumsden, 1902; Krasnicki, 1887)

t°.	Calcium Pelargonate. Gms. $Ca[CH_3(CH_2)_7COO]_2$ per 100 Gms H_2O.	Calcium Propionate. Gms. $Ca(CH_3CH_2COO)_2$ per 100 Gms. Water.	Solution.
0	0.16	42.80	29.97
20	0.14	39.85	28.48
40	0.13	38.45	27.76
60	0.12	38.25	27.67
80	0.15	39.85	28.48
90	0.18	42.15	29.66
100	0.26	48.44	32.63

CALCIUM SALICYLATE $Ca(C_6H_4.OHCOO)_2.3H_2O$.

100 grams of the saturated aqueous solution contain 2.29 grams of the anhydrous salt at 15° find 35.75 grams at 100°. (Tarugi and Checchi, 1901.)

CALCIUM SELENATE $CaSeO_4$.

SOLUBILITY IN WATER
(Etard — Ann. chim. phys. [7] 2, 532, '94.)

t°.	−1°.	+5°.	20°.	37°.	67°.
Gms. per 100 gms. sol.	7.4	7.3	7.6	6.8	5.1

The accuracy of these results appears questionable.

CALCIUM SILICATE $CaSiO_3$.

SOLUBILITY IN WATER AND IN AQUEOUS SUGAR SOLUTIONS AT 17°.
(Weisberg — Bull. soc. chim. [3] 15, 1097, '96.)

The sample of calcium silicate was air dried.

Solvent.	Grams per 100 cc. Saturated Solution. At 17°. CaO(det.)	At 17°. $CaSiO_3$(calc.)	After Boiling and Filtering Hot. CaO(det.)	After Boiling and Filtering Hot. $CaSiO_3$(calc.)
Water	0.0046	0.0095	...	...
10% sugar sol.	0.0065	0.0135	0.0094	0.0195
20% sugar sol.	0.0076	0.0157	0.0120	0.0249

FREEZING-POINT DATA (Solubility, see footnote, p. 1) ARE GIVEN FOR THE FOLLOWING MIXTURES OF CALCIUM SILICATE AND OTHER COMPOUNDS.

$CaSiO_3 + CaS$	(Lebedew, 1911.)
" $+ CaTiO_3$	(Smolensky, 1911–12.)
" $+ Li_2SiO_3$	(Wallace, 1909.)
" $+ MgSiO_3$	(Allen and White, 1911; Ginsberg, 1906.)
" $+ MnSiO_3$	(Ginsberg, 1908, 1909.)
" $+ Na_2SiO_3$	(Wallace, 1909; Kultascheff, 1903.)

CALCIUM SUCCINATE $Ca(C_2H_2O_2)_2$.

CALCIUM (Iso) **SUCCINATE** $CaCH_3.CHC_2O_4.H_2O$.

SOLUBILITY OF EACH IN WATER.
(Miczynski, 1886.)

Calcium Succinate. t°.	Gms $Ca(C_2H_2O_2)_2$ per 100 Gms. H_2O.	t°.	Gms. $Ca(C_2H_2O_2)_2$ per 100 Gms. H_2O.	Calcium Iso Succinate. t°.	Gms $Ca(C_2H_2O_2)_2$ per 100 Gms. H_2O.	t°.	Gms. $Ca(C_2H_2O_2)_2$ per 100 Gms. H_2O.
0	1.127	50	1.029	0	0.522	50	0.440
10	1.220	60	0.894	10	0.524	60	0.396
20	1.276	70	0.770	20	0.517	70	0.342
40	1.177	80	0.657	40	0.475	80	0.279

100 cc. H_2O dissolve 1.424 gms. $CaC_4H_4O_4.H_2O$ at 18° and 1.436 gms. at 25°
(Partheil and Hübner, 1903.)

100 gms. H_2O dissolve 1.28 gms. $CaC_4H_4O_4$ at 15° and 0.66 gms. at 100°.
(Tarugi and Checchi, 1901.)

Results for calcium succinate in water, varying considerably from the above and indicating an increase of solubility with temperature, are given by Cantoni and Diotalevi (1905) but the terms used for expressing the results are not stated.

100 cc. 95% alcohol dissolve 0.00136 gm. $CaC_4H_4O_4.H_2O$ at 18° and 0.00136 gm. at 25°. (Partheil and Hübner, 1903.)

CALCIUM SULFATE $CaSO_4.2H_2O$.

SOLUBILITY IN WATER.

(Hulett and Allen, 1902; for references to other determinations see Hulett and Allen, also Euler, 1904. For data by the electrolytic conductivity method, see Holleman, Kohlrausch and Rose, 1893, 1908.)

t°.	Gms. $CaSO_4$ per 100 cc. Solution.	Millimols per Liter.	Density of Solutions.	t°.	Gms. $CaSO_4$ per 100 cc. Solution.	Millimols per Liter.	Density of Solutions
0	0.1759	12.926	1.00197	40	0.2097	15.413	0.99439
10	0.1928	14.177	1.00173	55	0.2009	14.765	0.98796
18	0.2016	14.817	1.00059	65.3	0.1932	14.200	0.98256
25	0.2080	15.295	0.99911	75	0.1847	13.575	0.97772
30	0.2090	15.361	0.99789	100	0.1619	11.900	...
35	0.2096	15.405	0.99612	107	...	11.390	...

SOLUBILITY OF CALCIUM SULFATE ANHYDRITE AND OF SOLUBLE ANHYDRITE IN WATER. (Melcher, 1910.)

t°.	Millimols per Liter.	Gms. $CaSO_4$ per Liter.	Solid Phase.
100	11.65	1.586	$CaSO_4.2H_2O$
100	11.4	1.552	Soluble anhydrite
100	4.6	0.626	Anhydrite
156	3.2	0.436	Soluble anhydrite
156	1.35	0.184	Anhydrite
218	0.35	0.048	"

Data for the solubility of calcium sulfate in sea water are given by Manuelli, 1916.

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM ACETATE AT 25°. (Marden, 1916.)

Gms. CH_3COONH_4 per 100 Gms. Solution.	d_{25}.	Gms. $CaSO_4$ per 100 Gms. Sat. Solution.
0	1	0.2085
2.13	1.005	0.454
5.34	1.012	0.752
10.68	1.024	1.146
21.37	1.045	1.755

SOLUBILITY OF CALCIUM SULPHATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC, NITRIC, CHLOR ACETIC, AND FORMIC ACIDS.

(Banthisch — J. pr. Chem. 29, 52, '84; Lunge — J. Soc. Chem. Ind. 4, 32, '85.)

	In Hydrochloric.		In Nitric.	In Chlor Acetic.	In Formic.
Grams Acid per 100 cc. Solution.	Grams $CaSO_4$ per 100 cc. Sol. at 25°.	Grams $CaSO_4$ per 100 cc. Sol. at 102°.	Gms. $CaSO_4$ per 100 cc. Solution at 25°.	Gms. $CaSO_4$ per 100 cc. Sol. at 25°.	Gms. $CaSO_4$ per 100 cc. Sol. at 25°.
0	0.208	0.160	0.208	0.208	0.208
1	0.72	1.38	0.56	...	...
2	1.02	2.38	0.82	...	...
3	1.25	3.20	1.02	...	...
4	1.42	3.64	1.20	0.22	0.24
6	1.65	4.65	1.48	...	...
8	1.74	...	1.70	...	...
10	...	...	1.84	0.25	...
12	...	...	1.98	...	...

Data for the solubility of mixtures of $CaSO_4(NH_4)_2SO_4.H_2O + (NH_4)_2SO_4$ and of $CaSO_4(NH_4)_2SO_4.4H_2O + CaSO_4.2H_2O$ at various temperatures between 3° and 100° are given by Barre, 1909 and 1911. Additional data for this system, including results for the pentacalcium salt, $(NH_4)_2Ca_5(SO_4)_6.H_2O$, are given by D'Ans, 1909.

Solubility of Calcium Sulfate in Aqueous Solutions of Ammonium Salts.

(In NH_4Cl and NH_4NO_3, Cameron and Brown — J. Physic. Chem. 9, 210, '05; In $(NH_4)_2SO_4$ at 25°, Sullivan — J. Am. Chem. Soc. 27, 529, '05; In $(NH_4)_2SO_4$ at 50°, Bell and Tabor — J. Physic. Chem. 10, 119, '06.)

Gms. Ammonium Salt per Liter.	In NH_4Cl at 25°. G $CaSO_4$ Dissolved per Liter.	In NH_4NO_3 at 25°. G. $CaSO_4$ Dissolved per Liter	Gms. Ammonium Salt per Liter.	In NH_4Cl at 25°. G. $CaSO_4$ Dissolved per Liter.	In NH_4NO_3 at 25°. G. $CaSO_4$ Dissolved per Liter.
0	2.08	2.08	300	10.10	10.80
20	5.00	3.70	375	7.40	...
40	7.00	5.10	400	...	11.40
60	8.00	6.05	600	...	12.15
80	8.50	7.00	800	...	12.10
100	9.10	7.65	1000	...	11.81
150	10.30	8.88	1400	...	10.02
200	10.85	9.85	sat.	...	7.55

In $(NH_4)_2SO_4$ at 25°. Grams per Liter Sol. $(NH_4)_2SO_4$.	$CaSO_4$.	Wt. of 100 cc. Sat. Sol.	In $(NH_4)_2SO_4$ at 50°. Grams per Liter Sol. $(NH_4)_2SO_4$.	$CaSO_4$.	Sp. Gr. of Solutions.
0	2.08	99.91	0	2.168	...
0.129	2.04	99.91	15.65	1.609	1.0026
0.258	1.99	99.92	30.67	1.750	1.0113
0.821	1.81	99.95	91.6	2.542	1.0440
1.643	1.66	99.99	160.4	3.402	1.0819
3.287	1.54	100.10	221.6	4.068	1.1108
6.575	1.44	100.34	340.6	5.084	1.1653
13.15	1.46	100.82	416.5	5.354	1.1964
26.30	1.62	101.76	428.4	4.632	1.2043
84.9	2.33	105.34	530.8	2.152	1.2437
169.8	3.33	110.32	566	1.08	1.2508
339.6	4.50	119.15	566.7	0	1.2510

Solubility of Calcium Sulfate in Aqueous Solutions of Calcium Salts at 25°

(Cameron and Seidell — J. Physic Chem. 5, 643, '01, Seidell and Smith — *Ibid.* 8, 493, '04; Cameron and Bell — J. Am. Chem. Soc 28, 1220, '06.)

In Calcium Chloride. Grams per Liter Sol. $CaCl_2$.	$CaSO_4$.	In Calcium Nitrate. Gms. per Liter Sol. $Ca(NO_3)_2$.	$CaSO_4$.	Wt. of 1 cc. Sol.	In Calcium Hydroxide and *vice versa*. Gms. per Liter Sol. CaO.	$CaSO_4$.	Solid Phase.
0.00	2.06	0.0	2.08	0.998	0.0	2.126	$CaSO_4.2H_2O$
7.49	1.24	25	1.24	1.014	0.062	2.030	"
11.96	1.18	50	1.20	1.032	0.176	1.918	"
25.77	1.10	100	1.13	1.067	0.349	1.853	"
32.05	1.08	200	0.93	1.137	0.61	1.722	"
51.53	1.02	300	0.76	1.204	0.939	1.634	"
97.02	0.84	400	0.57	1.265	1.222	1.588	$CaSO_4.2H_2O + Ca(OH)_2$
192.71	0.47	500	0.40	1.328	1.242	1.214	$Ca(OH)_2$
280.30	0.20	544	0.35	1.352	1.150	0.666	"
367.85	0.03	...	...	...	1.166	0.00	"

Solubility of Calcium Sulfate in Aqueous Solutions of Copper Sulfate at 25°.

(Bell and Taber, 1907.)

Gms. per Liter Sat. Sol.		d_{25} Sat. Sol.	Gms. per Liter Sat. Sol.		d_{25} Sat. Sol.
$CuSO_4$.	$CaSO_4$.		$CuSO_4$.	$CaSO_4$.	
1.144	2.068	1.002	39.407	1.718	1.041
3.564	1.986	1.005	49.382	1.744	1.051
6.048	1.944	1.007	58.880	1.782	1.061
7.279	1.858	1.009	97.950	1.931	1.098
14.814	1.760	1.016	146.725	2.048	1.146
19.729	1.736	1.021	196.021	2.076	1.192
29.543	1.688	1.030	224.916	2.088	1.218

Solubility of Mixtures of Calcium Sulfate and Caesium Sulfate in Water.

(D'Ans, 1908.)

t°.	Mols. $Cs_2SO_4.CaSO_4$ per 1000 Gms. Sat. Sol.	= Gms. $Cs_2SO_4.CaSO_4$ per 1000 Gms. Sat. Sol	Solid Phase.
25	0.667	352	Dicalcium Sulfate + Gypsum
60	0.607	320	" "

Solubility of Calcium Sulfate in Aqueous Solutions of Magnesium Chloride and of Magnesium Nitrate at 25°.

(Cameron, Seidell, and Smith.)

In Magnesium Chloride. Grams per Liter of Sat. Solution.			In Magnesium Nitrate. Grams per Liter Solution.		Wt. of 1 cc. Solution.
$MgCl_2$.	$CaSO_4$.	H_2O.	$Mg(NO_3)_2$.	$CaSO_4$.	
0	2.08	997.9	0	2.08	0.9981
8.50	4.26	996.5	25	5.77	1.0205
19.18	5.69	994.5	50	7.88	1.0398
46.64	7.59	989.1	100	9.92	1.0786
121.38	8.62	972.2	200	13.34	1.1498
206.98	6.57	949.9	300	14	1.2190
337	2.77	908.7	400	14.68	1.2821
441.1	1.39	878.6	514	15.04	1.3553

Solubility of Calcium Sulfate in Aqueous Solutions of Magnesium Sulfate at 25°.

(Cameron and Bell, 1906a.)

Grams per Liter Solution.		Sp. Gr. of Solutions at $\frac{25}{25}$°.	Grams per Liter Solution.		Sp. Gr. of Solutions at $\frac{25}{25}$°.
$MgSO_4$.	$CaSO_4$.		$MgSO_4$.	$CaSO_4$.	
0	2.046	1.0032	149.67	1.597	1.1377
3.20	1.620	1.0055	165.7	1.549	1.1479
6.39	1.507	1.0090	171.2	1.474	1.1537
10.64	1.471	1.0118	198.8	1.422	1.1813
21.36	1.478	7.0226	232.1	1.254	1.2095
42.68	1.558	1.0419	265.6	1.070	1.2382
64.14	1.608	1.0626	298	0.860	1.2624
85.67	1.617	1.0833	330.6	0.647	1.2877
128.28	1.627	1.1190	355	0.501	1.3023

Solubility of Calcium Sulfate in Aqueous Solutions of Phosphoric Acid at 25°.

(Taber, 1906.)

Gms. per Liter. P_2O_4.	Gms. per Liter. $CaSO_4$.	Sp. Gr. of Solutions at $\frac{25}{25}$.	Gms. per Liter. P_2O_5.	Gms. per Liter. $CaSO_4$.	Sp. Gr. of Solutions at $\frac{25}{25}$.
0	2.126	0.9991	145.1	7.920	1.106
5	3.143	1.002	205	8.383	1.145
10.5	3.734	1.007	311.5	7.965	1.221
21.4	4.456	1.016	395.8	6.848	1.280
46.3	5.760	1.035	494.6	5.572	1.344
105.3	7.318	1.075			

Solubility of Calcium Sulfate in Aqueous Solutions of Sulfuric Acid.

(Cameron and Breazeale, 1903.)

Grams H_2SO_4 per Liter of Solution.	Results at 25°. Gms. $CaSO_4$ per Liter.	Results at 25°. Wt. of 1 cc. Sol.	Results at 35°. Gms. $CaSO_4$ per Liter.	Results at 43° Gms. $CaSO_4$ per Liter.
0.00	2.126	0.9991 grams	...	2.145
0.48	2.128	1.0025 "	2.209	2.236
4.87	2.144	1.0026 "	2.451	2.456
8.11	2.203	1 0051 "	...	2.760
16.22	2.382	1 0098 "	...	3.116
48.67	2.727	1 0302 "	3.397	3 843
75 00	2 841	1 0435 "	...	4.146
97.35	2.779	1.0756 "	3.606	...
146 01	2.571	... "	3.150	4.139
194.70	2.313	1.1134 "	...	3.551
243.35	1.901	1.1418 "	...	2.959
292.02	1.541	1.1681 "	...	2.481

Solubility of Calcium Sulfate in Aqueous Solutions of Potassium Chloride, Bromide, and Iodide at 21°.

(Ditte, 1898)

Grams of the Potassium Salt per Liter.	In KCl Solutions. Gms. $CaSO_4$ per Liter.	In KBr Solutions. Gms. $CaSO_4$ per Liter.	In KI Solutions. Gms. $CaSO_4$ per Liter.
0	2.05	2.05	2.05
10	3.6	3 1	2.8
20	4.5	3.6	3.2
40	5.8	4.5	3.9
60	6.6	5.2	4 5
80	7.2	5 9	4 85
100	7.5	6.3	5.1
125	double salt	6.7	5.45
150	...	7.0	5.8
200	...	7.3	5.95
250	...	double salt	6.00
300	...	...	double salt

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE AND OF POTASSIUM SULFATE AT 25°.

(Seidell and Smith, 1904; Cameron and Breazeale, 1904.)

In Potassium Nitrate.			In Potassium Sulphate.		
Gms. per Liter Solution.		Wt. of 1 cc. Solution.	Gms. per Liter Solution.		Wt. of 1 cc. Solution.
KNO_3.	$CaSO_4$.		K_2SO_4.	$CaSO_4$.	
0.0	2.08	0.9981	0.0	2.08	0.9981
12.5	3.28	1.0081	4.88	1.60	1.0036
25.0	4.08	1.0154	5.09	1.56	1.0038
50.0	5.26	1.0321	9.85	1.45	1.0075
100.0	6.86	1.0625	19.57	1.49	1.0151
150	7.91	1.0924	28.35	1.55	1.0229
200	8.69	1.1224	30.66	1.57	1.0236
260	syngenite	1.1539	32.47	1.58*	...

* Solid phase syngenite. Results for the solubility of syngenite in solutions of potassium sulphate are also given in the original paper.

Data for the solubility of syngenite, $K_2Ca(SO_4)_2.H_2O$, and of potassium pentacalcium sulfate, $K_2Ca_5(SO_4)_6.H_2O$, in water at various temperatures, are given by D'Ans (1909). This author also gives results for the effect of the following salts upon the concentration of the boundary solution for gypsum-potassium syngenite at 25°: KCl, KBr, KI, $KClO_3$, $KClO_4$, KNO_3, CH_3COOK, KOH, $K_4Fe(CN)_6$, $K_3Fe(CN)_6$, NaCl, NaI, $NaNO_3$, CH_3COONa, HCl, HNO_3, H_3PO_4, CH_3COOH, H_2SO_4, Ag_2SO_4 and cane sugar.

Data for the solubility of mixtures of $CaSO_4.K_2SO_4.H_2O + CaSO_4.2H_2O$ and $CaSO_4.K_2SO_4.H_2O + K_2SO_4$ in water at temperatures between 0° and 99°, are given by Barre (1909, 1911).

Data for mixtures of gypsum-rubidium syngenite and of dicalcium salt-syngenite, at temperatures between 0° and 40°, are given by D'Ans (1909).

SOLUBILITY OF CALCIUM SULFATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT 26°.

(Cameron, 1901; also Orloff, 1902; Cloez, 1903; d'Anselme, 1903.)

Grams per 100 cc. Solution.		Wt. of 1 cc. Solution.	Grams per 100 cc. Solution.		Wt. of 1 cc. Solution.
NaCl.	$CaSO_4$.		NaCl.	$CaSO_4$.	
0	0.2121	0.9998	17.650	0.712	1.1196
9.115	0.666	1.0644	22.876	0.679	1.1488
14.399	0.718	1.0981	26.417	0.650	1.1707
14.834	0.716	1.1012	32.049	0.572	1.2034

SOLUBILITY OF MIXTURES OF CALCIUM SULFATE AND CALCIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT 23°.

(Cameron and Seidell, 1901a)

Grams per Liter Solution.			Grams per Liter Solution.		
NaCl.	$Ca(HCO_3)_2$.	$CaSO_4$.	NaCl.	$Ca(HCO_3)_2$.	$CaSO_4$.
0	0.060	1.930	79.52	0.060	6.424
3.63	0.072	2.720	121.90	0.056	5.272
11.49	0.089	3.446	193.80	0.048	4.786
39.62	0.101	5.156	267.60	0.040	4.462

Data for the solubility of mixtures of calcium sulfate and sodium chloride at 0°-99° are given by Arth and Cretien (1906).

Data for the equilibrium $CaSO_4 + Na_2CO_3 \rightleftarrows CaCO_3 + Na_2SO_4$ at 25° are given by Herz (1911a).

Solubility of Mixtures of Calcium Sulfate and Silver Sulfate in Water.

(Euler, 1904.)

t°.		Per Liter of Solution. Gms. Salt.	Gms. Equiv. Salt.	Total Salt per 100 Gms. Solution	Sp. Gr. of Solutions.
17°	$CaSO_4$	2.31	0.034	0.9473	1.0083
	Ag_2SO_4	7.235	0.0464		
25°	$CaSO_4$	2.61	0.0383	1.062	1.010
	Ag_2SO_4	8.11	0.0520		

Solubility of Calcium Sulfate in Aqueous Solutions of Sodium Nitrate and of Sodium Sulfate at 25°.

(Seidell, Smith, Cameron, Breazeale)

In Sodium Nitrate. Gms. per Liter Solution. $NaNO_3$.	$CaSO_4$.	Wt. of 1 cc. Solution.	In Sodium Sulfate. Gms per Liter Solution. Na_2SO_4.	$CaSO_4$.	Wt. of 1 cc. Solution.
0	2.08	0.9981	2.39	1.65	1.0013
25	4.25	1.0163	9.54	1.45	1.0076
50	5.50	1.0340	14.13	1.39	1.0115
100	7.10	1.0684	24.37	1.47	1.0205
200	8.79	1.1336	46.15	1.65	1.0391
300	9.28	1.1916	115.08	2.10	1.0965
600	7.89	1.3639	146.61	2.23	1.1427
655	7.24	1.3904	257.10	2.65	1.2120

Data for the solubility of calcium sulfate, sodium sulfate glauberite, sodium sulfate syngenite, separately and mixed, in water at various temperatures, are given by D'Ans (1909) and Barre (1911).

Solubility of Calcium Sulfate in Aqueous and Alcoholic Monopotassium Tartrate Solutions at 20°.

(Magnanini, 1901.)

Solvent.	Gms $CaSO_4$ per 100 Gms. Solution.	Solvent	Gms. $CaSO_4$ per 100 Gms. Solution.
Water	0.2238	10% alcoholic N/200 $KHC_4H_4O_6$	0.0866
Aq. N/200 $KHC_4H_4O_6$	0.2323	Aq. N/200 $KHC_4H_4O_6$+5% tartaric acid	0.2566
10% alcohol	0.0970	10% alc. N/400 $KHC_4H_4O_6$+5% tartaric acid	0.1086

Solubility of Calcium Sulfate in Aqueous Sugar Solutions.

(Stolle, 1900)

Per cent Concentration of Sugar Solutions.	Gms $CaSO_4$ Dissolved by 1000 Gms of the Sugar Solutions at: 30°.	40°.	50°	60°.	70°.	80°.
0	...	2.157	1.730	1.730	1.652	1.710
10	2.041	1.730	1.730	1.574	1.574	1.613
20	1.808	1.652	1.419	1.380	1.419	1.263
27	1.550	1.438	1.361	1.283	1.283	0.972
35	1.263	1.050	1.088	1.108	0.914	...
42	1.030	...	0.777	0.816	0.855	0.729
49	...	0.564	0.739	0.564	0.603	0.486
55	...	0.486	0.505	0.486	0.369	0.330

100 gms. glycerol of d_{15} 1.256 dissolve 5.17 gms. $CaSO_4$ at 15°-16°. (Ossendowski, 1907.)
100 gms. glycerol of d 1.114 dissolve 0.95 gm. $CaSO_4$ at ord. temp. (Asselin, 1873.)

FREEZING-POINT DATA (Solubilities, see footnote, p. 1) ARE GIVEN FOR THE FOLLOWING MIXTURES OF CALCIUM SULFATE AND OTHER SALTS:

Calcium Sulfate + Lithium Sulfate	(Müller, 1910.)
" " + Potassium Sulfate	(Müller, 1910; Grahmann, 1913.)
" " + Rubidium Sulfate	(Müller, 1910.)
" " + Sodium Sulfate	(Müller, 1910; Calcagni and Mancini, 1910.)

CALCIUM SULPHIDE CaS.

SOLUBILITY IN AQUEOUS SUGAR SOLUTIONS.
(Stolle.)

Per cent Concentration of Sugar Solutions.	Grams CaS Dissolved per Liter of the Sugar Solutions at: 30°.	40°.	50°.	60°.	70°.	80°.	90°.
0	1.982	2.123	1.235	1.390	1.696	2.032	2.496
10	1.866	1.316	1.441	1.673	1.560	1.634	1.544
20	2.187	1.696	1.802	1.905	1.879	1.892	1.930
27	2.522	2.097	2.059	2.226	2.342	2.304	2.357
35	2.689	2.265	2.304	2.406	2.342	2.857	2.947
42	2.342	2.136	2.226	2.522	2.574	2.509	2.689
49	2.445	2.290	2.458	2.638	2.728	2.818	3.063
55	2.509	2.226	2.340	2.882	2.766	2.972	3.616

CALCIUM SULFITE $CaSO_3 2H_2O$.

SOLUBILITY IN WATER AND IN AQUEOUS SUGAR SOLUTIONS AT 18°.
(Weisberg, 1896.)

Solvent.	Grams $CaSO_3$ per 100 cc. Solution. At 18°.	After Boiling Solution 2 Hours.
Water	0.0043	....
10 Per cent Sugar	0.0083	0.0066
30 Per cent Sugar	0.0080	0.0069

RESULTS AT HIGHER TEMPERATURES.
(Van der Linden, 1916.)

Solvent.	Gms. $CaSO_3.2H_2O$ per 1000 gms. Sat. Solution at. 30°.	40°.	50°.	60°.	70°.	80°.	90°.	b. pt.
Water	0.064	0.063	0.057	0.061	0.045	0.031	0.027	0.011
Aq. Sucrose of 15 gms. per 100 cc.	0.103	0.083	0.073	0.080	0.059	0.041	0.036	0.041
Aq. Sucrose, 15 gms.+1.5 gms. Glucose per 100 cc.	0.104	0.081	0.085	0.071	0.060	0.047	0.040	0.029
Water+Excess $CaSO_4$	0.031	0.029	0.025	0.019	0.012	0.009	0.008	0.006
Aq. Sucrose, 15 gms. per 100 cc. +Excess $CaSO_4$	0.035	0.032	0.022	0.019	0.021	0.017	0.020	0.021
Aq. Sucrose, 15 gms.+1.5 gms. Glucose per 100 cc.+Excess $CaSO_4$	0.032	0.027	0.022	0.020	0.019	0.019	0.019	0.023

CALCIUM Phenanthrene SULFONATES.

SOLUBILITY IN WATER.
(Sandquist, 1912.)

Compound.	Gms. Anhydrous Salt per 100 Gms. H_2O.
Calcium- 2-Phenanthrene Monosulfonate	0.024
" - 3- " " $.2H_2O$	0.083
" -10- " " $.2H_2O$	0.30

CALCIUM TARTRATE $CaC_4H_4O_6.4H_2O$.

SOLUBILITY IN WATER.
(Cantoni and Zachoder, 1905)

t°.	Gms. $CaC_4H_4O_6.4H_2O$ per 100 cc Sol.	t°.	Gms. $CaC_4H_4O_6.4H_2O$ per 100 cc. Sol.	t°.	Gms. $CaC_4H_4O_6.4H_2O$ per 100 cc. Sol.
0	0.0365	30	0.0631	70	0.1430
10	0.0401	40	0.0875	80	0.1798
20	0.0475	50	0.1100	85	0.2190
25	0.0525	60	0.1262		

100 gms. aq. Ca. tartrate solution contain 0.0185 gm. $CaC_4H_4O_6.4H_2O$ at 18°, and 0.029489 gm. at 25°.

100 gms. 95% alcohol solution contain 0.0187 gm. $CaC_4H_4O_6.4H_2O$ at 18°, and 0.02352 gm. at 25°. (Partheil and Hübner, 1903.)

100 gms. aq. Ca. tartrate solution contain 0.0364 gm. $CaC_4H_4O_6$ at 20°.

100 gms. 10% alcohol solution contain 0.0160 gm. $CaC_4H_4O_6$ at 20°.

100 gms. aqueous 5% tartaric acid solution contain 0.1632 gm. $CaC_4H_4O_6$ at 20°. (Magnanini, 1901)

SOLUBILITY OF CALCIUM TARTRATE, $CaC_4H_4O_6.4H_2O$, IN AQUEOUS ACETIC ACID SOLUTIONS AT 26°-27°.
(Herz and Muhs, 1903; see also Enell, 1899)

Normality of Acetic Acid.	Gms. CH_3COOH per 100 cc. Sol.	Residue from 50 052 cc Sol.	Normality of Acetic Acid.	Gms. CH_3COOH per 100 cc Sol.	Residue from 50 052 cc. Sol.
0	0	0.0217	3.80	22.80	0.2042
0.57	3.42	0.1082	5 70	34.20	0.1844
1.425	8.55	0.1635	10 09	60.54	0.1160
2.85	17.10	0.1970	16.505	93.03	0.0337

The residue was dried at 70° C.

SOLUBILITY OF CALCIUM TARTRATE IN AQUEOUS SOLUTIONS OF CALCIUM CHLORIDE, TARTARIC ACID, ETC., AT 18°.
(Paul, 1915)

(The determinations were made by weighing the tartrate remaining undissolved and calculating the amount dissolved by difference. It was found that even a small amount of CO_2 in the water had a distinct influence on the solubility. One liter of pure CO_2 free water was found to dissolve 0.380 gm. $CaC_4H_4O_6.4H_2O$ at 18° and one liter of ordinary distilled water, 0.410 gm. at the same temperature.)

Results for Aqueous Calcium Chloride Solution. Gms. per Liter		Results for Aqueous Dipotassium Tartrate Sols. Gms per Liter		Results for Aqueous Tartaric Acid Sols. Gms per Liter		Results for Alcoholic Tartaric Acid Sols. Gms per Liter.		
$CaCl_2$.	$CaC_4H_4O_6$ $4H_2O$.	$K_2C_4H_4O_6$. $\frac{1}{2}H_2O$.	$CaC_4H_4O_6$. $4H_2O$.	$C_4H_6O_6$.	$CaC_4H_4O_6$. $4H_2O$.	C_2H_5OH.	$C_4H_6O_6$.	$CaC_4H_4O_6$. $4H_2O$
0.503	0.202	0.392	0.166	1	0.910	50	0	0.263
1.005	0.179	2.139	0.160	2	1.162	"	4	1.107
3.518	0.166	2.352	0.157	4	1.511	"	16	1.85
4.523	0.154	2.614	0.150	6	1.776	80	0	0.205
5.025	0.154	4.705	0.223	8	1.972	"	4	0.867
7 538	0.171	23.524	0.263	10	2.205	"	16	1.506
10.05	0.177	47.048	0.305	12	2.380	100	0	0.190
25.125	0.182			14	2.514	"	4	0.766
50.25	0.224			16	2.643	"	16	1.297

Data for the effect of potassium chloride and of potassium acetate upon the solubility of calcium tartrate in aqueous 0.5 normal acetic acid solutions at 25°, and also for the effect of potassium monochloracetate upon the solubility of the salt in 0.5 normal chloracetic acid solutions at 25°, are given by Henderson and Taylor (1916).

SOLUBILITY OF CALCIUM TARTRATE IN AQUEOUS SOLUTIONS OF AMMONIUM, POTASSIUM AND SODIUM CHLORIDES AT SEVERAL TEMPERATURES.

(Cantoni and Jolkowsky, 1907.)

NOTE. — (The authors refer in all cases to their determination of the amount of decomposition of the tartrate by the aqueous chloride solutions. Constant agitation and temperature were maintained.)

Gms. Chloride per Liter Solvent.	Gms. Ca Tartrate Dissolved at 16° per Liter of Aq.:			t°.	Gms. Ca Tartrate per Liter of 7% Aqueous:		
	NH_4Cl.	KCl.	NaCl		NH_4Cl.	KCl.	NaCl.
5	0.701	0.643	0.680	16	1.676	1.504	1.637
10	0.861	0.822	0.840	30	2.417	2.031	2.275
30	1.281	1.180	1.305	55	3.712	2.154	3.579
100	1.897	1.753	1.860	70	5.080	2.546	4.148
200	2.305	2.110	2.163	85	6.699	4.264	6.305

CALCIUM BITARTRATE $CaH_2(C_4H_4O_6)_2$.

SOLUBILITY IN WATER AND IN AQUEOUS SOLUTIONS OF ACIDS AND OF SALTS.

(Warington — J. Chem. Soc. 28, 946, '75.)

In Hydrochloric Acid.

Conc. of HCl Gms. per 100 Gms. Sol.	Gms. $CaH_2(C_4H_4O_6)_2$ per 100 Gms. Solvent.	
	At 22°.	At 80°.
0	0.600	4.027
0.68	3.01	5.35
2.15	6.88	11.35
4.26	11.19	20.23
8.36	22.75	40.93
16.13	48.31	80.12

100 gms. H_2O dissolve 0.422 gms. bitartrate at 14°

In other Acids and in Salt Solutions at 14°.

Acid or Salt.	Gms. Acid or Salt per 100 cc. Sol.	Gms. $CaH_2(C_4H_4O_6)_2$ per 100 cc. Sol.
Acetic Acid	0.81	0.422
Tartaric Acid	1.03	0.322
Citric Acid	0.84	0.546
Sulphuric Acid	0.685	1.701
Hydrochloric Acid	0.504	1.947
Nitric Acid	0.845	1.969
Potassium Acetate	1.387	0.744
Potassium Citrate	1.397	0.843

CALCIUM THIOSULFATE $CaS_2O_3.6H_2O$.

SOLUBILITY OF CALCIUM THIOSULFATE IN AQUEOUS SOLUTIONS OF SODIUM THIOSULFATE AT 9° AND 25° AND VICE VERSA.

(Kremann and Rodemund, 1914.)

Results at 9°.

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$Na_2S_2O_3$.	CaS_2O_3.	
0	29.4	$CaS_2O_3.6H_2O$
11.04	22.64	"
25.21	15.84	" $+Na_2S_2O_3.5H_2O$
31.01	7.70	$Na_2S_2O_3.5H_2O$

Results at 25°.

Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$Na_2S_2O_3$.	CaS_2O_3.	
0	34.7	$CaS_2O_3.6H_2O$
9.24	29.69	"
15.67	21.41	"
18.34	25.18	"
28.24	21.14	"
30.19	20.33	" $+Na_2S_2O_3.5H_2O$
31.24	18.43	$Na_2S_2O_3.5H_2O$
35.04	11.61	"

Data are also given for the quaternary systems, $CaS_2O_3+Na_2S_2O_3+NaNO_3+H_2O$ and $CaS_2O_3+Ca(NO_3)_2+NaNO_3+H_2O$ at 9° and 25°. A triple salt of the composition $CaNa_3(S_2O_3)_2NO_3.11H_2O$ was obtained.

CALCIUM VALERATE $Ca[CH_3(CH_2)_3COO]_2.H_2O$.

CALCIUM (Iso) VALERATE $Ca[(CH_3)_2.CH.CH_2.COO]_2.3H_2O$.

SOLUBILITY OF EACH IN WATER.

(Lumsden — J. Chem. Soc. 81, 355, '02; see also Furth — Monatsh. Chem. 9, 313, '88; Sedlitzky — *Ibid*, 8, 566, '87.)

Calcium Valerate.			Calcium Iso Valerate.			
t°.	Gms. $Ca(C_5H_9O_2)_2$ per 100 Gms. Water.	Solution.	t°.	Gms. $Ca(C_5H_9O_2)_2$ per 100 Gms. Water.	Solution.	Solid Phase.
0	9.82	8.94	0	26.05	20.66	$Ca(C_5H_9O_2)_2.3H_2O$
10	9.25	8.47	10	22.70	18.50	"
20	8.80	8.09	20	21.80	17.90	"
30	8.40	7.75	30	21.68	17.82	"
40	8.05	7.45	40	22.00	18.18	"
50	7.85	7.28	45.5	22.35	18.42	"
57	7.75	7.19	50	19.95	16.63	$Ca(C_5H_9O_2)_2.H_2O$
60	7.78	7.22	60	18.38	15 52	"
70	7.80	7.24	70	17.40	14 82	"
80	7.95	7.36	80	16.88	14.44	"
90	8.20	7.58	90	16.65	14.28	"
100	8.78	8.07	100	16.55	14.20	"

CAMPHENE $C_{10}H_{16}$.

Freezing-point data (solubility, see footnote, p. 1) are given by Kurnakov and Efrenov (1912) for mixtures of camphene + methylmustard oil, camphene + naphthalene and camphene + phenanthene.

CAMPHOR $C_{10}H_{16}O$ *d* and *l*.

APPROXIMATE SOLUBILITY OF *d* CAMPHOR IN SEVERAL SOLVENTS AT ORDINARY TEMPERATURE. (U. S P., Squires; Greenish and Smith, 1903.)

Solvent	Parts Camphor per 100 Parts Solvent.	Solvent.	Parts Camphor per 100 Parts Solvent
Water	0.08–0.14	Chloroform	300–400
90% Alcohol	100	Olive Oil	25–33
95% Alcohol	125	Turpentine	66
Ether	173	Glacial Acetic Acid	200
Carbon Disulfide	Readily Soluble	Lanolin	12.5 (Klose, 1907).

Saturated solutions of *d* camphor and of *l* camphor in turpentine of $\alpha_D = 4.38$ (in a 10 cm. tube at 18°) were found to have $d_{15} = 0.9028$ and 0.9030 respectively; the α_D in a 10 cm. tube were +23.07 and −16.52 respectively. (Jones, 1907–08.)

SOLUBILITY OF CAMPHOR IN CONCENTRATED AQUEOUS HYDROCHLORIC ACID. (Zaharia, 1899.)

(The dissolved camphor could not be determined by evaporating and weighing the residue on account of volatility; polarimetric methods could not be used on account of the interference of the HCl. The author, therefore, determined the densities (H_2O at 4° in each case) of the pure solvent and saturated solution in each case, and assumed that the difference represented the weight of camphor dissolved. The saturated solutions were prepared by stirring the several mixtures with a glass stirring rod, at intervals, during 6 hours.)

Solvent.	Densities at 0° Solvent.	Sat. Sol.	Densities at 10° Solvent	Sat Sol.	Densities at 20°. Solvent.	Sat Sol.	Densities at 40°. Solvent.	Sat Sol.
27.2 % HCl	1.145	1.143	1.140	1 138	1 135	1.133	1 125	1 123
30.6 "	1.164	1.159	1.158	1 153	1 153	1.148	1 142	1 138
33.9 "	1.181	1 167	1 175	1 163	1 169	1 159	1 157	1.149
34.98 "	1 187	1.158	1.181	1 160	1 175	1 158	1 163	1.153
35.74 "	1.191	1.140	1 185	1 148	1 179	1 153	1 167	1.153
36.38 "	1.195	1.126	1.189	1 134	1 182	1 140	1 170	1.153
36.68 "	1.197	1.116	1.190	1.124	1.184	1.134	...	...

Reciprocal Solubility of Camphor and Phenol, Determined by the Freezing-point Method.

(Wood and Scott, 1910.)

(The freezing-point was determined in most cases by measuring the rate of cooling of the mixtures and ascertaining the point at which the rate changed. The experiments were made with very great care.)

t° of Freezing.	Gms. Camphor per 100 Gms. Mixture.	Solid Phase.	t° of Freezing.	Gms. Camphor per 100 Gms Mixture.	Solid Phase.	t° of Freezing.	Gms. Camphor per 100 Gms. Mixture.	Solid Phase.
174.5	100.0	$C_{10}H_{16}O$	−13.8	71 48	$C_{10}H_{16}O$	−22 6	52.52	1.1
158	95.98	"	−26.4, −32	70.12	" +1 1	−23 6	44 90	"
140	92 55	"	−15 9	69.32	1.1	−28−30.5	40.35	" + C_6H_5OH
112	88 86	"	−20.1	67.76	"	−15.7	38.57	C_6H_5OH
80	82.88	"	−19.3	66.64	"	−3	34.50	"
50.7	79.73	"	−18.7	62.21	"	+5	30 31	"
29 5	76.58	"	−18.6 m. pt.	...	"	16.1	25 40	"
−0.1	73 37	"	−20.1	61.51	"	25	20 31	"
−13.5	72.24	"	−20	55.80	"	36.1	6.87	"

1.1 = $C_{10}H_{16}O.C_6H_5OH$.

Data for the above system obtained by the method of determination of the temperature of disappearance of the last crystal, are given by Kremann, Wischo and Paul (1915). The results are not in good agreement with the above. These authors also give similar determinations for the systems camphor+resorcinol and camphor+β naphthol.

Data for the systems camphor + phenol + water, camphor + *n* butyric acid + water, camphor + succinic acid nitrile + water and camphor + triethylamine + water are given by Timmermans, 1907.

Freezing-point data (solubilities, see footnote, p. 1) are given for the following mixtures of camphor and other compounds.

Camphor + Borneol	(Vanstone, 1909.)
" + Hydroquinone	(Efremov, 1912, 1913.)
" + Menthol	(Pawlewski, 1913.)
" + α Naphthol	(Caille, 1909)
" + β Naphthol	(Caille, 1909.)
" + α Mononitronaphthalene	(Journiaux, 1912.)
" + Naphthalene	" "
" + β Naphthylamine	" "
" + Nitric Acid	(Zukow and Kasatkin, 1909.)
" + Phosphoric Acid	" "
" + Pyrocatechol	(Efremov, 1912, 1913.)
" + Pyrogallol	(Journiaux, 1912)
" + Resorcinol	(Caille, 1909; Efremov, 1912, 1913.)
" + Salol	(Caille, 1909)
" + Sulfur Dioxide	(Bellucci and Grassi, 1913, 1914.)
" + α Trinitrotoluene	(Giua, 1916.)
" + *p* Toluidine	(Efremov, 1915, 1916.)
" + 17 other compounds	" "

BenzolCAMPHOR Enol and keto forms.

Solubility data have been used by Dimroth and Mason (1913) for determining the transition of the tautomeric forms into each other. Results are given for the solubility of each form in ether, acetone, ethylacetate, ethyl alcohol and methyl alcohol.

One liter benzene dissolves 256 gms. *enol* benzoylcamphor at 5°, by freezing-point method. (Sidgwick, 1915.)

BromoCAMPHOR α $C_{10}H_{15}OBr$.

APPROXIMATE SOLUBILITY IN SEVERAL ORGANIC SOLVENTS AT ORDINARY TEMP.
(U. S. P.; Squires; Beilstein; results in alcohol by Müller, 1892)

Solvent.	Parts Bromo Camphor per 100 Parts Solvent.	Solvent.	Parts Bromo Camphor per 100 Parts Solvent.
Alcohol	12.1 at 15°	Ether	50
"	19.7 " 25°	Chloroform	143
"	130.0 " 50°	Olive Oil	12.5
"	705.0 " 61°	95% Formic Acid	13.6 (Aschan, 1913.)

Freezing-point data (solubility, see footnote, p. 1) are given for mixtures of *l* bromocamphor + *d* chlorocamphor by Padoa (1904); for mixtures of *d* bromocamphor + *l* bromocamphor by Padoa and Rotondi (1912); for mixtures of bromocamphor + stearine by Batelli and Martinetti (1885); β bromocamphor + salol by Caille, 1909.

CAMPHOROXIME $C_{10}H_{16}$: NOH *d* and *l*.

100 gms. turpentine dissolve 8.68 gms. *d* oxime at 18°, $d_{18} = 0.8784$, $\alpha_D = 2.30$ in 10 cm. tube.

100 gms. turpentine dissolve 8.69 gms. *l* oxime at 18°, $d_{18} = 0.8782$, $\alpha_D = 18.24$ in 10 cm. tube.

α_D of the turpentine = 4.38 in a 10 cm. tube at 18°.

In the case of results in *l* amyl bromide the $d_{15} = 1.199$ in both cases and the α_D was -3.55 (10 cm. tube) for the *d* oxime and $+11.48$ for the *l* oxime. The α_D of the amyl bromide was $+4.6$ in 10 cm. tube at 18°. The results show that the solubility and rotatory power of the *d* and *l* isomerides are identical in an optically active as well as in an inactive solvent.

Freezing-point data are given for mixtures of *d* and *l* camphoroxime by Beck (1904) and Adriani (1900).

CAMPHORIC ACID $C_8H_{14}(COOH)_2$.

100 gms. of water dissolve 0.8 gm. $C_8H_{14}(COOH)_2$ at 25°, and 10 gms. at the b. pt. (U.S.P.)

SOLUBILITY OF CAMPHORIC ACID IN AQUEOUS SOLUTIONS OF ALCOHOL AT 25°.
(Seidell, 1908, 1910)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat Sol.	Gms $C_8H_{14}(COOH)_2$ per 100 Gms Sat Sol.	Wt % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms $C_8H_{14}(COOH)_2$ per 100 Gms. Sat. Sol.
0	1	0.754	60	1	45
10	1	1.60	70	1	49
20	1	6.30	80	0.995	51.20
30	1	14	90	0.980	51.40
40	1	26	96.3	0 970	50.37
50	1	31	100	0.960	50.10

SOLUBILITY OF CAMPHORIC ACID IN SEVERAL SOLVENTS.

Solvent.	t°.	d_{25} of Sat Sol	Gms. $C_8H_{14}(COOH)_2$ per 100 Gms Solvent	Solvent.	t°.	d_{25} of Sat. Sol.	Gms. $C_8H_{14}(COOH)_2$ per 100 Gms Solvent.
Amyl Alcohol(iso)	25	0 907	50(3)	Carbon Disulfide	25	1 258	0 020(3)
Butyl Alcohol(iso)	22.5	...	54 1(1)	Chloroform	25		0 153(3)
Ethyl Alcohol	0	...	84 7(1)	Cumene	25	0.890	0.197(3)
" "	15 1	...	112(2)	Ether (abs.)	25	0 922	91 40(3)
" "	62.5	..	147(2)	95% Formic Acid	18 5	. .	8.68(4)
Methyl Alcohol	0	...	116.3(1)	Ligroin	25	0 714	0 007(3)
" "	22 5	...	131 1(1)	Nitrobenzene	25	1 2	0 5(3)
Propyl Alcohol	0	...	42.2(1)	Spts. Turpentine	25	0 852	1 74(3)
" "	22 5	..	61 (1)	Toluene	25	0 862	0.15(3)
Benzene	25	0 873	0 008(3)	Xylene	25	0 859	0.23(3).

(1) Timofeiew (1914); (2) Beilstein; (3) Seidell (1910); (4) Aschan, (1913)

Data for the distribution of camphoric acid between water and ether at 25° are given by Chandler (1908). Data for the freezing points of mixtures of *d* and *l* camphoric acid and *d* and *l* isocamphoric acid are given by Centnerszwer (1899).

CAMPHORIC ANHYDRIDE $C_{10}H_{14}O_3$ *d* and *l*.

One liter of benzene dissolves 37.5 gms. *d* camphoric anhydride at 5°, determined by depression of the freezing-point. (Sidgwick, 1915.)

Approximate Solubility in Several Solvents at Room Temp.
(Self and Greenish, 1907.)

Solvent.	Gms. Cantharidine per 100 Gms. Solvent.	Solvent.	Gms. Cantharidine per 100 Gms. Solvent.
Aq. 25% Acetone	0.02	Aq. 10% Acetic Acid	0.14
" 50% "	0.16	" 45% Formic "	0.12
" 75% "	0.45	Carbon Tetrachloride	0.04
		Lanolin	4.4 (Klose, 1907.)

CAOUTCHOUC.

Solubility in Organic Solvents. (Hanausek, 1887.)

Solvent.	Gms. Caoutchouc Dissolved per 100 Gms. Solvent. Ceara.	Tete Noire.	Sierra Leone.
Ether	2.5	3.6	4.5
Turpentine	4.5	5	4.6
Chloroform	3	3.7	3
Petroleum	1.5	4.5	4
Benzene	4.4	5	4.7
Carbon Disulfide	0.4	0	0

Solubility of Caoutchouc in Mixtures of Benzene and Alcohol. (Caspari, 1915.)

(Freshly prepared solutions of deresinified caoutchouc in benzene were titrated with alcohol to appearance of two phases. The end point is sharp to within one drop of precipitant, especially at low concs. of caoutchouc. For purposes of converting the weights of caoutchouc to volume, the factor 0.91 may be taken.)

Results at 20°.

Gms. Caoutchouc.	cc. C_6H_6.	cc. Abs. C_2H_5OH.	Gms. Caoutchouc	cc C_6H_6.	cc. 95% C_2H_5OH.	Gms. Caoutchouc.	cc. C_6H_6.	cc. 92% C_2H_5OH.
0.032	40	17	0.206	40	11	0.80	40	9.6
0.080	40	15.8	0.81	40	10.8	2.01	40	8.8
0.405	40	14.8	2.01	40	10.2	3.20	40	8.1
2.404	40	14.5	3.22	40	9.8			
4.061	40	13.8						

Results at 40°. Gms. Caoutchouc.	cc. C_6H_6	cc. Abs. C_2H_5OH.	Results at 60°. Gms. Caoutchouc.	cc. C_6H_6.	cc. Abs. C_2H_5OH.
0.2	40	18.8	0.2	40	21.6
1.0	40	18.1	1	40	23.3
2	40	17.4	2	40	24.4

Solubility of Caoutchouc in Mixtures of Benzene and Acetone. (Caspari, 1915.)

Results at 20°. Gms. Caoutchouc.	cc. C_6H_6.	cc. $(CH_3)_2CO$.	Results at 40°. Gms Caoutchouc.	cc. C_6H_6.	cc. $(CH_3)_2CO$.	Results at 60°. Gms. Caoutchouc.	cc. C_6H_6.	cc. $(CH_3)_2CO$.
0.11	20	15.7	0.10	20	19.6	0 10	20	23
0.80	20	15.0	0.98	20	17.6	1.01	20	26.4
1.86	20	14.7						

CARBAMIDES.

Solubility in Several Solvents. (Walker and Wood, 1898.)

as Methyl phenyl carbamide (m. pt. 82°), benzyl carbamide (m. pt. 149°). *o* tolyl carbamide (m. pt. 185°) and *p* tolyl carbamide (m. pt. 173°).

Solvent.	t°.	Gms. Each Carbamide Separately per 100 cc. Sat. Solution. *as* Methyl Phenyl.	Benzyl.	*p* Tolyl.	*o* Tolyl
Water	45	74	1.71	0.307	0.251
Acetone	23	29.4	3.10	2.66	0.462
Ether	22.5	2.28	0.053	0.062	0.0162
Benzene	44.2	12.4	0.0597	0.043	0.0155

100 gms. chloroform dissolve 0.6–0.7 gm. diiododithio carbamide $(CSN_2H_4)_2I_2$ at temp. not stated. (Werner, 1912.)

CARBAZOLE (Diphenylene imide) $(C_6H_4)_2NH$.

100 grams abs. alcohol dissolve 0.92 gm. $(C_6H_4)_2NH$ at 14°, and 3.88 gms. at b. pt.

100 gms. toluene dissolve 0.55 gm. $(C_6H_4)_2NH$ at 16.5°, and 5.46 gms. at b. pt.

Freezing-point data are given for mixtures of carbazole and phenanthene by Garelli (1894).

CARBINOL CH_3OH, see Methyl alcohol, p. 435.

Trimethyl **CARBINOL** $(CH_3)_3COH$, Triphenyl **CARBINOL** $(C_6H_5)_3COH$.

Freezing-point data (solubilities, see footnote, p. 1) are given for mixtures of trimethyl carbinol and water by Paterno and Mieli (1907). Results for trimethyl carbinol + phenol, trimethyl carbinol + thymol and trimethyl carbinol + bromotoluene are given by Paterno and Ampola (1897). Results for triphenyl carbinol + phenol are given by Yamamoto (1908).

CARBON DIOXIDE CO_2.

SOLUBILITY IN WATER.

(Bohr, 1899, Geffcken, 1904, Just, 1901.)

t°.	Solubility in Water. q.	β	l.	In 6.53% NaCl. β.	In 17.62% NaCl. β.
0	0.335	1.713	...	1.234	0.678
5	0.277	1.424	...	1.024	0.577
10	0.231	1.194	...	0.875	0.503
15	0.197	1.019	1.070	0.755	0.442
20	0.169	0.878	...	0.664	0.393
25	0.145	0.759	0.826	0.583	0.352
30	0.126	0.665	...	0.517	0.319
40	0.097	0.530	...	0.414	0.263
50	0.076	0.436	...	0.370	0.235
60	0.058	0.359	...	0.305	0.183

q = wt. of gas dissolved by 100 grams of solvent at a total pressure of 760 mm.

β = the **Bunsen Absorption Coefficient** which signifies the volume (v) of the gas (reduced to 0° and 760 mm.) taken up by unit volume (V) of the liquid when the pressure of the gas itself minus the vapor tension of the solvent is 760 mm.

$$\beta = \frac{v}{V(1 + 0.00367\,t)}.$$

l = the **Ostwald Solubility Expression** which represents the ratio of the volume (v) of gas absorbed at any pressure and temperature, to the volume (V) of the absorbing liquid, i.e. $l = \frac{v}{V}$. This expression differs from the Bunsen Absorption Coefficient, β, in that the volume (v) of the dissolved gas is not reduced to 0° and 760 mm. The solubility l is therefore the volume of gas dissolved by unit volume of the solvent at the temperature of the experiment. The two expressions are related thus:

$$l = \beta\,(1 + 0.00367\,t), \quad \beta = \frac{l}{(1 + 0.00367\,t)}.$$

SOLUBILITY IN WATER AT PRESSURES ABOVE ONE ATMOSPHERE.

(Wroblewski — Compt. rend. 94, 1335, '82.)

Pressure in Atmospheres.	Coefficient of Saturation * at: 0°.	12.4°.	Pressure in Atmospheres.	Coefficient of Saturation * at: 0°.	12.4°.
1	1.797	1.086	20	26.65	17.11
5	8.65	5.15	25	30.55	20.31
10	16.03	9.65	30	33.74	23.25

* Coefficient of absorption is no doubt intended.

Solubility of Carbon Dioxide in Water at High Pressures. (Sander, 1911–12.)

NOTE. — The pressures varied from 25 to 170 kilograms per square centimeter. The results are expressed in terms of the volume of CO_2, reduced to 1 kg. per sq. centimeter, dissolved by unit volume of liquid at the temperature and pressure of the experiment. A Caillet apparatus, provided with the well-known Caillet tube, was used. The experiments were made with very great care. In general, the procedure consisted in compressing CO_2 above mercury in the closed millimeter graduated end of the Caillet tube and taking many readings on the scale at various pressures and temperatures. The volumes thus found were compared with similar readings made after a known amount of solvent had been introduced above the layer of mercury, by means of a graduated pipet with turned-up end. The differences show the volume of CO_2 dissolved at given temperatures and pressures.

Two series of determinations were made. In the case of the results marked (*a*) the used volume of water was 0.210 cc. and for those marked (*b*) the volume was 0.102 cc. The volumes of CO_2 used, varied from 60 to 76 cc.

t°.	Pressure in Kg. per Sq. Cm.	cc. of CO_2 (Reduced to 1 Kg. per Sq. Cm.) Dissolved by 1 cc H_2O. (*a*)	(*b*)	t°.	Pressure in Kg. per Sq. Cm.	cc. CO_2 (Reduced to 1 Kg. per Sq. Cm.) Dissolved by 1 cc H_2O. (*a*)	(*b*)
20	25	...	17.77	60	90	22.74	21.16
"	30	...	19.77	"	100	26.22	27.85
"	40	...	21.52	"	110	28.92	28.79
"	50	...	28.09	"	120	30.20	33.90
"	55	...	29.75	100	60	8.97	...
35	30	11.77	13.57	"	70	10.11	6.40
"	40	14.82	20	"	80	11.05	9.59
"	50	18.96	24.64	"	90	12.62	10.85
"	60	22.90	22.50	"	100	13.63	12.40
"	70	27.18	27.62	"	110	14.88	16.31
"	80	...	32.85	"	120	16.40	15.78
60	40	10.88	9.80	"	130	17.93	16.89
"	50	12.24	13.72	"	140	19.56	17.71
"	60	14.46	15.28	"	150	20.58	17.49
"	70	16.80	17.46	"	160	22.07	...
"	80	19.74	22.67	"	170	22.78	...

Solubility of Carbon Dioxide in Water Expressed in Terms of the Fahrenheit Scale of Temperature and Pounds per Square Inch Pressure.

(Heath, 1915; Anthony, 1916, see also Riley, 1911)

(The existing data were calculated to this form, particularly for use in the bottling industry.)

Pounds per Sq. Inch Pressure	Volumes of CO_2 Gas Dissolved by One Volume of Water at: 32°.	36°.	40°	44°.	48°.	55°.	60°.	65°.	70°.	75°.	80°.	85°.	90°.
15	3.46	3.19	2.93	2.70	2.50	2.20	2.02	1.86	1.71	1.58	1.84	4.35	1.27
20	4.04	3.73	3.42	3.15	2.92	2.57	2.36	2.17	2	1.84	1.69	1.58	1.48
25	4.58	4.27	3.92	3.61	3.35	2.04	2.69	2.48	2.29	2.10	1.93	1.80	1.70
30	5.21	4.81	4.41	4.06	3.77	3.31	3.03	2.80	2.58	2.37	2.18	2.03	1.91
35	5.80	5.35	4.91	4.52	4.19	3.69	3.37	3.11	2.86	2.63	2.42	2.26	2.13
40	6.37	5.89	5.39	4.97	4.61	4.05	3.71	3.42	3.15	2.89	2.67	2.49	2.34
45	6.95	6.43	5.88	5.43	5.03	4.43	4.06	3.74	3.44	3.16	2.91	2.72	2.56
50	7.53	6.95	6.36	5.89	5.45	4.80	4.40	4.05	3.73	3.42	3.16	2.94	2.77
55	8.11	7.48	6.86	6.34	5.87	5.17	4.74	4.37	4.02	3.69	3.40	3.17	2.99
60	8.71	8.02	7.35	6.79	6.29	5.53	5.08	4.68	4.31	3.95	3.64	3.39	3.20
70	9.86	9.09	8.33	7.70	7.13	6.27	5.76	5.30	4.89	4.49	4.14	3.86	3.63
80	11.02	10.17	9.31	8.61	7.98	7	6.43	5.92	5.46	5.02	4.62	4.31	4.06
90	12.18	11.25	10.30	9.52	8.82	7.74	7.11	6.54	6.04	5.55	5.12	4.77	4.49
100	13.34	12.33	11.29	10.43	9.66	8.4	7.79	7.18	6.62	6.08	5.60	5.22	4.91

Solubility of CO_2 in Aqueous Solutions of Acids and Salts.

(Geffcken.)

Aq Solvent.	Gms. Acid per Liter.	CO_2 Dissolved, l at: 15°.	25°.	Aq. Solvent	Gms Salt per Liter.	CO_2 Dissolved, l at: 15°.	25°.
HCl	18.23	1.043	0.806	CsCl	84.17	1.006	0.781
"	36.46	1.028	0.799	KCl	37.30	0.976	0.759
"	72.92	1.000	0.795	KCl	74.60	0.897	0.700
HNO_3	31.52	1.078	0.840	KI	83.06	0.992	0.775
"	63.05	1.086	0.853	KI	166.12	0.923	0.727
"	126.10	1.100	0.877	KBr	59.55	0.986	0.768
H_2SO_4	24.52	1.018	0.794	KBr	119.11	0.914	0.713
"	49.04	0.978	0.770	KNO_3	50.59	1.005	0.784
"	98.08	0.917	0.730	KNO_3	101.19	0.946	0.749
"	147.11	0.870	0.698	RbCl	60.47	0.989	0.769
"	196.15	0.828	0.667	RbCl	120.95	0.921	0.788

Solubility in Aqueous Solutions of Salts. (Mackenzie, 1877)

Salt in Solution.	Gms Salt per 100 Gms Solution.	Density of Solution 15°.	Absorption Coefficient α at 8°	15°	22°
KCl	6.05	1.021	0.988	0.777	0.670
"	8.646	1.053	0.918	0.777	0.649
"	11.974	1.080	0.864	0.720	0.597
"	22.506	1.549	0.688	0.571	0.480
NaCl	7.062	1.038	0.899 (6.4°)	0.735	...
"	12.995	1.080	0.633 (6.4°)	0.557	0.482
"	17.42	1.123	0.518 (6.4°)	0.431	0.389
"	26.00	1.195	0.347 (6.4°)	0.297	0.263
NH_4Cl	6.465	1.021	1.023	0.825	0.718
"	8.723	1.047	1.000	0.791	0.702
"	12.727	1.053	0.922	0.798	0.684
"	24.233	1.072	0.813 (10°)	0.738	0.600

Salt in Solution.	Gms Salt per 100 Gms Solution.	Density of Solution 15°.	8°	16.5°.	22°	30°.
$BaCl_2$	7.316	1.068	0.969	0.744	0.680	0.566
"	9.753	1.092	1.021	0.645	0.607	0.543
"	14.030	1.137	...	0.618	0.524	0.467
"	25.215	1.273	0.495	0.618	0.383	0.315
$SrCl_2$	9.511	1.087	0.779	0.663	0.581	0.508
"	12.325	1.1159	0.737	0.586	0.507	0.539
"	17.713	1.173	0.606	0.473	0.444	0.367
"	31.194	1.343	0.285	0.245	0.247	0.223
$CaCl_2$	4.365	1.036	0.942	0.759	0.673	0.596
"	5.739	1.049	0.855	0.726	0.616	0.527
"	8.045	1.068	0.838	0.674	0.581	0.500
"	15.793	1.139	0.632	0.520	0.471	0.400

Data for the solubility of CO_2 in sea water are given by Hamberg (1885).

According to Fox (1909a), analyses of sea water all show an excess of base over acid, that is, when CO_2 is left out of account. This CO_2 (about 50 cc per liter) is, of course, in equilibrium with the excess of base, which is actually equal to about 40 mgs. OH per liter. The partial pressure of CO_2 very seldom, if ever, exceeds 6 in 10,000. For the determination of the absorption coefficient of CO_2 there are, consequently, four independent variables to be considered; influence of alkalinity, a chemical influence in addition to the purely physical influences of temperature, pressure and salinity. For convenience, the dissolved CO_2 may be considered as made up of two parts, about 1% dependent upon physical influences alone and a far larger part dependent upon the alkalinity, pressure and temperature, but independent of salinity. Extensive experimental determinations are described.

A critical review of the literature on the solubility of carbon dioxide in water and in sea water is given by Coste (1917).

SOLUBILITY OF CARBON DIOXIDE IN AQUEOUS SOLUTIONS OF SALTS AT 15.2°.
(Setschenow, 1892.)

(Results expressed in terms of cc. CO_2 (at 0° and 760 mm.) dissolved per 1 cc. sat. solution.)

Salt.	Gms. Salt per Liter.	Dissolved CO_2.	Salt.	Gms. Salt per Liter.	Dissolved CO_2.	Salt.	Gms. Salt per Liter.	Dissolved CO_2.
NH_4Cl	1	1.005	LiCl	16.72	1.035	NaCl	12.9	0.978
"	10	0.985	"	50.15	0.808	"	64	0.760
"	51.6	0.941	"	125.4	0.596	"	128	0.580
"	172	0.819	"	250.8	0.497	"	192	0.466
"	258	0.770	"	501.5	0.120	NaBr	115.1	0.775
NH_4NO_3	2.8	1.013	$MgSO_4$	26.5	0.901	"	460 3	0.364
"	11.2	1.002	"	79.5	0.669	"	690.4	0.221
"	55	0.989	"	159	0.441	$NaNO_3$	89 3	0 835
"	101	0.962	"	318	0.188	"	125	0.762
"	202.1	0.911	KBr	83.9	0.908	"	208 4	0.621
"	404.3	0.807	"	167.7	0.819	"	416.8	0.385
"	810.4	0.612	"	251.5	0.748	"	625.2	0.244
$(NH_4)_2SO_4$	72.2	0.712	"	503.1	0.579	$NaClO_3$	233.3	0.625
"	144.4	0.575	KI	319.1	0.777	"	349.9	0.506
$Ba(NO_3)$	62.7	0.922	"	478.6	0.688	"	699.8	0.257
$Ca(NO_3)_2$	41	0.923	"	957.3	0.506	Na_2SO_4	14 2	0.950
Citric Acid	12	1.007	KSCN	326	0.691	"	94.8	0.620
"	49	0.975	"	489	0.590	"	284.4	0.234
"	99	0.950	"	978	0.387	$ZnSO_4$	38.3	0.903
"	198	0.893	KNO_3	58.8	0.959	"	76.7	0.783
"	298	0.841	"	117.5	0.890	"	230	0.474
"	595	0.719	"	235.1	0.781	"	460	0.209

Several determinations at other temperatures are also given.

SOLUBILITY OF CARBON DIOXIDE IN AQUEOUS SALT SOLUTIONS AT 25°.
(Findlay and Shen, 1912)

Salt.	Gms. Salt per 100 cc. Solution.	d of Sat. Sol.	Solubility of CO_2, Ostwald Expression l_{25}.	Salt.	Gms. Salt per 100 cc. Solution.	d of Sat. Sol.	Solubility of CO_2, Ostwald Expression l_{25}.
Water alone	...	...	0.825	$Fe(SO_4)(NH_4)_2SO_4.6H_2O$	9.51	1.052	0.641
NH_4Cl	2.35	1.005	0.791	"	10.26	1.057	0.629
"	5.05	1.013	0.754	"	22.47	1.124	0.460
"	10.02	1.022	0.732	KCl	1.84	1.008	0.792
"	17.09	1.045	0.665	"	3.05	1 017	0.764
$BaCl_2$	2.80	1.018	0.789	"	4.58	1 026	0.749
"	5.81	1.040	0.741	"	7.46	1.044	0 701
"	8.15	1.054	0.710	Sucrose	2 63	1.009	0 813
"	9.97	1.070	0.676	"	5.16	1.018	0.798
Chloral Hydrate	5 08	1.019	0.815	"	9.68	1.038	0.767
"	10.12	1.041	0.795	"	12.33	1.051	0.744

Data for KCl solutions at higher pressures are given by Findlay and Creighton, 1910.

Data for the influence of colloids and fine suspensions upon the solubility of carbon dioxide in water at 25° and at various pressures are given by Findlay, 1908; Findlay and Creighton, 1910, 1911; Findlay and Shen, 1911, 1912; Findlay and Williams, 1913; Findlay and Howell, 1915.

The solubility of CO_2 increases slightly with increasing concentrations of $Fe(OH)_3$, gelatine, silicic acid, aniline (chem. combination occurs), methyl orange, blood, serum, peptone, protopeptone, and commercial hemoglobin. The solubility diminishes slightly with increasing concentrations of arsenious sulfide, dextrine, soluble starch, glycogen (?), egg albumen and serum albumen. No appreciable effect is produced by suspensions of charcoal or silica.

When the solubility is increased by a given substance, the solubility curve falls with increase of pressure; when it is lessened, the curve rises with increasing pressure. In the case of starch and other neutral colloids, the solubility passes through a minimum with increase of pressure.

Data for the influence of colloids and suspensions on the evolution of CO_2 from supersaturated solutions, are given by Findlay and King, 1913–14.

Solubility of Carbon Dioxide in Aqueous Salt Solutions at 15.5° and 760 mm. Pressure.

(Christoff, 1905)

A gravimetric method was used. A stream of CO_2 was passed through the weighed salt solution and, after saturation, the solution again weighed and the difference taken to represent absorbed CO_2. The loss of water from the solution was prevented by first passing the CO_2 through a series of U-tubes containing some of the same solution. Constant temp. was not employed, but corrections of the results were made for the slight variations in temp. which occurred. Absorption flasks of special shape, graduated to hold 75 cc., were used.

Salt in Aq. Solution.	Conc. of Aq. Sol.	Gms CO_2 Absorbed per 75 cc. Solvent.	Salt in Aq. Solution.	Conc of Aq. Sol.	Gms CO_2 Absorbed per 75 cc. Solvent.
Water Alone	...	0 1382	$K_4P_4O_{12}$	1 normal	0.1237
$(NH_4)_2SO_4$	1 normal	0 1093	$KHSO_4$	0 66 "	0.1020
$(NH_4)_2Fe_2(SO_4)_4.24H_2O$	1 "	0 0991	"	2. "	0 1000
$K_2Al_2(SO_4)_4.24H_2O$	1 "	0 1054	K_2SO_4	0 66 "	0 1140
$NH_4HB_2O_4$	0 25 "	0 7672	"	1	0 1002
$CuSO_4$	2 "	0 0751	$Na_4B_4O_7$	0 025 "	0 2205
LiCl	1 "	0 1087	"	0 125 "	0 5317
$MgSO_4$	0.5 "	0 1209	"	0 25 "	0.8511
"	1 "	0 1020	"	sat. sol.	1 8285
"	2 "	0 0662	"	" +crysts.	3 2240
"	4 "	0 0527	$NaBO_2$	0 25 normal	0 8122
KBr	1 "	0 1280	NaCl	1 "	0.1050
KCl	1 "	0 1213	$Na_3PO_4.12H_2O$	1 "	0 5828
KI	1 "	0 1204	$Na_4P_2O_7.10H_2O$	1 "	0 8463
KNO_3	1 "	0 1231	$Na_4P_4O_{12}$	1 "	0 0700
K_2HAsO_4	0.5 "	0 1110	$ZnSO_4$	2 "	0.0720
$KH_2As_3O_4$	1 "	0 0812	Sugar	0 1 "	0 1225
KH_2PO_4	1 "	0 0860	"	0.5 "	0.1089
K_2HPO_4	0.5 "	0.4900(?)	"	1 "	0.0931

Solubility of Carbon Dioxide in Aqueous Solutions of Sulfuric Acid.

Results at 15.5°. (Christoff, 1905) Results at 20°. (Christoff, 1906.)

Per cent H_2SO_4 in Solvent.	Gms CO_2 Absorbed per 75 cc Solvent.	Per cent H_2SO_4 in Solvent.	Gms CO_2 Absorbed per 75 cc Solvent.	Per cent H_2SO_4 in Solvent.	Solubility of CO_2, Ostwald Expression l_{20}
2.5	0.1282	40	0.0713	0	0.9674
5	0.1079	45	0.0725	35.82	0.6521
10	0.0833	70	0.0918	61.62	0.7191
20	0.0755	90	0.1433	95.6	0.9924
30	0.0751			96	$\beta = 0.926$ (Bohr, 1910.)

Solubility of Carbon Dioxide in Aqueous Solutions of Chloral Hydrate and of Glycerol at 15°.

Results in terms of the Bunsen absorption coefficient β, and also the Ostwald solubility expression l (see p. 227). (von Hammel, 1915.)

In Aq. Chloral Hydrate. In Aq. Glycerol.

Gms. $CCl_3.CH(OH)_2$ per 100 Gms. Aq. Sol.	Abs Coef., β_{15}.	Solubility, l_{15}.	Gms. $(CH_2OH)_2CHOH$ per 100 Gms. Aq. Sol	Abs Coef., β_{15}.	Solubility, l_{15}.
17.7	0.885	0.935	0	1.008	1.064
31.6	0.803	0.848	26.11	0.785	0.829
38.3	0.781	0.825	43.72	0.639	0.675
49.8	0.760	0.802	62.14	0.511	0.540
57.1	0.765	0.808	77.75	0.430	0.454
68.8	0.797	0.842	90.74	0.404	0.427
79.4	0.903	0.953	99.26	0.410	0.438

Solubility of Carbon Dioxide in Alcohol.

(Bohr — Wied. Ann. Physik. [4] 1, 247, '00)

t°.	In 99 per cent Alcohol. cc. CO_2 (at 0° and 760 mm.) per 1 cc. Alcohol.	Sat. Solution.	In 98.7 per cent Alcohol. cc. CO_2 (at 0° and 760 mm) per 1 cc. Alcohol.	Sat. Solution.
−65	38.41	35.93	39.89	37.22
−20	7.51	7.41	7.25	7.16
−10	5.75	5.69	5.43	5.38
0	4.44	4.40	4.35	4.31
+10	3.57	3.55	...	...
20	2.98	2.96	...	...
25	2.76	2.74	...	...
30	2.57	2.56	...	...
40	2.20	2.19	...	...
45	2.01	2.00	...	...

Solubility in Aqueous Alcohol at 20°.

(Muller, 1889; Lubarsch, 1889)

Density of Alcohol.	Per cent Alcohol by Wt.	Abs. Coef. of CO_2, α.	Density of Alcohol.	Per cent Alcohol by Wt.	Abs. Coef. of CO_2, α.
0.998	1.07	0.861	0.922	49.0	0.982
0.969	22.76	0.841	0.870 (18.8°)	71.1	1.293
0.960 (22.4°)	28.46	0.792	0.835 (16°)	85.3	1.974
0.956	31.17	0.801	0.795 (19°)	99.7	2.719
0.935 (17°)	42.15	0.877			

Solubility in Aqueous Alcohol at 25°.

(Findlay and Shen, 1911)

Results for alcohol, of d_{25}^{25} = 0.9931 (2.95 gms. per 100 cc.). Pressure m.m. Hg.	Solubility of CO_2, Ostwald Expression l_{25}.	Results for alcohol, of d_{25}^{25} = 0.9929 (3.01 gms. per 100 cc.). Pressure m.m. Hg.	Solubility of CO_2, Ostwald Expression l_{25}.	Results for alcohol, of d_{25}^{25} = 0.9834 (8.83 gms. per 100 cc.). Pressure m.m. Hg.	Solubility of CO_2, Ostwald Expression l_{25}.
737	0.812	745	0.814	747	0.786
836	0.813	937	0.815	942	0.784
1073	0.811	1083	0.813	1090	0.785
1338	0.811	1357	0.812	1360	0.788

These authors also showed that the solubility of CO_2 in wort containing 13 gms. solids per 100 cc. is less than in water; also that the solubility of CO_2 in beer is less than in aqueous alcohol solutions of alcohol content equal to that of the beer.

Solubility of Carbon Dioxide in Aqueous Solutions of Non-Electrolytes at 20°.

Results in terms of the Bunsen Absorption Coefficient β, see p. 227. (Usher, 1910.)

Aqueous Solution of:	Gm. Mols per Liter.	d_{20} of Aq. Sol.	Absorption Coef β.	Aqueous Solution of:	Gm. Mols. per Liter.	d_{20} of Aq. Sol.	Absorption Coef. β.
Water Alone	...	...	0.877	Resorcinol	0.5	1.0096	0.901
Sucrose	0.125	1.0152	0.846	Catechol	0.5	1.0107	0.868
"	0.25	1.0313	0.815	Urethan	0.5	1.0037	0.869
"	0.50	1.0637	0.756	Carbamide	0.5	1.0072	0.864
"	1	1.1281	0.649	Thiocarbamide	0.5	1.0092	0.859
Dextrose	0.5	1.0328	0.792	Antipyrine	0.5	1.0134	0.859
Mannitol	0.5	1.0303	0.782	Acetamide	0.5	1.0005	0.879
Glycine	0.5	1.0141	0.843	Acetic Acid	0.5	1.0026	0.868
Pyrogallol	0.5	1.0172	0.853	*n* Propyl Alcohol	0.5	0.9939	0.869
Quinol	0.5	1.0095	0.887				

Solubility of Carbon Dioxide in Organic Solvents at Low Temperatures and Pressures. (Stern, 1912–13.)

Very accurate determinations with an elaborate apparatus. The results are expressed in terms of K' = the number of cc. of CO_2, reduced to 0°, absorbed at the indicated pressure by 1 gram of liquid. This number differs from the Bunsen absorption coefficient only by a constant factor which is the density d of the liquid. Therefore Bunsen coef. $\beta = K'd$. The results are also expressed in terms of the Ostwald solubility expression l (see p. 227).

t°.	Pressure in m.m. Hg.	Solvent, C_2H_5OH. $d_{-78/4} = 0.872$. $d_{-59/4} = 0.856$.		Solvent, CH_3OH. $d_{-78/4} = 0.884$. $d_{-59/4} = 0.866$.		Solvent, $(CH_3)_2CO$. $d_{-78/4} = 0.900$ $d_{-59/4} = 0.879$.		Solvent, $CH_3CO_2.C_2H_5$. $d_{-78/4} = 1.017$. $d_{-59/4} = 0.994$		Solvent, $CH_3CO_2CH_3$. $d_{-78/4} = 1.056$. $d_{-59/4} = 1.032$	
		K'.	l.	K'	l	K'.	l	K'.	l.	K'.	l.
−78	50	107	...	194	120.5	311	196.6	250.2	177.5	304.9	224.1
"	100	111.8	68.4	195	119.6	322	198.1	255.6	177.1	315	224.3
"	200	115.7	69.5	202.9	120.1	344.5	201.5	271.8	179.2	337.4	223.1
"	400	123.8	71.4	221.5	122.2	400	208.8	310.9	183.2	389.3	225.6
"	700	138.6	74.7	260	126.8	545.5	...	...	..	...	. .
−59	100	40.85	27.27	63	42.5	97.8	67.2	85.3	65.6	94.3	75.8
"	200	41	27.16	64.2	42.7	101.2	68	86.3	65.3	98.45	77.1
"	400	42.35	27.65	66.3	43.1	106.6	72.8	91.6	66.7	103.6	77.6
"	700	44.15	28.10	69	43.35	118.8	72.8	101.5	69.7	112.9	79

Solubility of Carbon Dioxide in Organic Solvents at High Pressures.

(See Note, p. 228.) (Sander, 1911–12.)

Pressure in Kg. per Sq. Cm.	Cc. of CO_2 (Reduced to 1 Kg per Sq Cm) Dissolved at the Temp. and Pressure of Experiment by 1 cc of Sat. Solution in: C_2H_5OH (0.093 cc)	C_3H_7OH (0.103 cc)	$(C_2H_5)_2O$ (0.131 cc)	$CH_3COOC_2H_5$ (0.155 cc)	C_6H_6 (0.08 cc)	C_6H_5Cl (0.106 cc)	C_6H_5Br (0.113 cc)	$C_6H_5NO_2$ (0.164 cc.)	$C_6H_5CH_3$ (0.114 cc.)
				Results at 20°.					
20	...	56.16	...	...	71.16	62.61	50.83	57.12	57.91
30	104.8	86.62	...	188.2	125.3	95.22	82.29	92.50	103.3
40	149.7	122.1	...	227.9	192.4	137.3	121.1	115.9	155.9
50	188.8	174.6	...	...	264.3	187.5	160	155.9	235.8
				Results at 35°.					
20	...	40	...	. .	48.65	46.66	43.38	44.48	49.6
40	113.1	98.16	...	188.4	138.3	101.5	90.43	94.39	118.8
60	173	159.9	241.3	219.8	243.1	168.3	146	145.1	192.1
80	...	269.6	...	...	. .	. .	233.9	227	...
				Results at 60°.					
20	...	24.73	...	. .	34.57	35.86	30.58	31.38	. .
40	72.82	64.65	...	140.5	88.71	73.69	62.64	52.26	78.67
60	122.5	111.5	195.4	186.7	156.6	118.1	98.73	72.15	128.1
80	167.9	159.2	221.4	223.4	215	149.3	131.4	85.03	171.9
100	195.7	213.9	248.7	..	284.4	...	169.7	...	210
				Results at 100°.					
30	...	...	...	.	.	33.65	30.56	41.09	28.68
40	...	26.5	...	80.70	46.52	48.16	41.49	50.36	49.25
60	66.05	74.51	101	132	91.27	77.24	72.64	70.85	85.98
80	111.2	107.7	142.8	162.3	155.8	103	92.86	86.86	117.6
100	145.7	144.7	175.4	191.5	212.9	121.5	118	...	149
120	174.6	175.4	...	...	258.2	140.7	140.7	...	171.8
130	182.6	...	...	...	...	146.8	...	...	178.2

The figures in parentheses immediately below the formulas of the solvents in the above table, show the volumes of solvent used for the series of determinations in each case. The volumes of CO_2 varied from about 55 to 77 cc. in the several cases. The increasing content of CO_2 in the solvents at increasing pressures caused a considerable increase in volume of the solvent. This was determined and the proper calculation of the readings to the saturated solution were made. All necessary figures to show the extent of the applicability of Henry's Law in the present case, are given.

Solubility of Carbon Dioxide in Organic Solvents.

(Just, 1901.)

The determinations are described in great detail. Results are given in terms of the Ostwald solubility expression l (see p. 227).

Solvent.	l_{25}.	l_{20}.	l_{15}.	Solvent.	l_{25}.	l_{20}.	l_{15}.
Water	0.8256	...	...	Benzene	2.425	2.540	2.710
Glycerol	0.0302	...	...	Amylbromide	2.455	2.638	2.803
Carbon Disulfide	0.8699	0.8888	0.9446	Nitrobenzene	2.456	2.655	2.845
Iodobenzene	1.301	1.371	1.440	Propyl Alcohol	2.498	...	...
Aniline	1.324	1.434	1.531	Carvol	2.498	2.690	2.914
o Toluidine	1.381	1.473	1.539	Ethyl Alcohol (97%)	2.706	2.923	3.130
m "	1.436	1.581	1.730	Benzaldehyde	2.841	3.057	3.304
Eugenol	1.539	1.653	1.762	Amylchloride	2.910	3.127	3.363
Benzene Trichloride	1.643	...	...	Isobutylchloride	3.105	3.388	3.659
Cumol	1.782	1.879	1.978	Chloroform	3.430	3.681	3.956
Carven	1.802	1.921	2.030	Butyric Acid	3.478	3.767	4.084
Dichlorhydrine	1.810	1.917	2.034	Ethylene Chloride	3.525	3.795	4.061
Amyl Alcohol	1.831	1.941	2.058	Pyridine	3.656	3.862	4.291
Bromobenzene	1.842	1.964	2.092	Methyl Alcohol	3.837	4.205	4.606
Isobutyl Alcohol	1.849	1.964	2.088	Amylformate	4.026	4.329	4.646
Benzylchloride	1.938	2.072	2.180	Propionic Acid	4.078	4.407	4.787
Metoxylol	2.090	2.216	2.346	Amyl Acetate	4.119	4.411	4.850
Ethylenebromide	2.157	2.294	2.424	Acetic Acid (glacial)	4.679	5.129	5.614
Chlorobenzene	2.265	2.420	2.581	Isobutyl Acetate	4.691	4.968	...
Carbontetrachloride	2.294	2.502	2.603	Acetic Anhydride	5.206	5.720	6.218
Propylenebromide	2.301	2.453	2.586	Acetone	6.295	6.921	...
Toluene	2.305	2.426	2.557	Methyl Acetate	6.494	...	...

Solubility of Carbon Dioxide in Ethyl Ether. Results in Terms of the Ostwald Solubility Expression l.

(Christoff, 1912.)

$l_0 = 7.330$. $\qquad l_{10} = 6.044$. $\qquad l_{15} = 5.465$.

Data for the solubility of carbon dioxide in mixtures of acetic acid and carbon tetrachloride and of ethylene chloride and carbon disulfide are given by Christoff, 1905.

Data for the adsorption of CO_2 by *p* azoxyphenetol at temperatures below and above its melting point, show that no adsorption or solution occurs while the material is in the solid (unmelted) condition, but after the first melting, absorption takes place and as soon as the isotropic liquid phase is reached, a second very well-marked increase in absorption is observed. After this, expansion and decrease of solubility proceed regularly with rise of temp. (Homfray, 1910.)

The absorption coefficient β of CO_2 in Russian petroleum was found by Gniewosz and Walfisz (1887) to be 1.17 at 20° and 1.31 at 10°.

Data for the absorption of CO_2 by rubber and carbon are given by Reychler (1910).

Data for the absorption of CO_2 by hemoglobin are given by Jolin (1889).

Data for the distribution of CO_2 between air and H_2O, air and aq. H_2SO_4 and air and toluene at various temperatures, are given by Hantzsch and Vagt (1901).

Data for the freezing-points of mixtures of CO_2 and methyl-ether and for CO_2 and methyl alcohol are given by Baume and Perrot (1911, 1914).

CARBON DISULFIDE CS_2.

SOLUBILITY IN WATER.
(Chancel and Parmentier, 1885; Rex, 1906.)

t°.	Grams CS_2 per 100 cc. Solution.	Grams CS_2 per 100 Gms. H_2O (Rex).	t°.	Grams CS_2 per 100 cc. Solution.	Grams CS_2 per 100 Gms. H_2O (Rex).
0	0.204	0.258	30	0.155	0.195
5	0.199	...	35	0.137	...
10	0.194	0.239	40	0.111	...
15	0.187	...	45	0.070	...
20	0.179	0.217	49	0.014	...
25	0.169	...			

100 cc. H_2O dissolve 0.174 cc. CS_2 at 22°; Vol. of solution = 100.208, Sp. Gr. = 0.9981.
100 cc. CS_2 dissolve 0.961 cc. H_2O at 22°; Vol. of solution = 100.961, Sp. Gr. = 1.253. (Herz, 1898.)

SOLUBILITY OF CARBON DISULFIDE IN:

Aq. Solutions of Ethyl Alcohol at 17°.
(Tuchschmidt and Folleuins, 1871)

Wt. per cent Alcohol.	cc. CS_2 per 100 cc. Solvent.	Wt. per cent Alcohol.	cc. CS_2 per 100 cc. Solvent.
100	∞	91.37	50
98.5	182	84.12	30
98.15	132	76.02	20
96.95	100	48.40	2
93.54	70	47.90	0

Methyl Alcohol.
(Rothmund, 1898.)

t°.	Wt. per CS_2 in: CH_3OH Layer.	Wt. per CS_2 in: CS_2 Layer.
10	45.1	98.3
20	50.8	97.2
25	54.2	96.4
30	58.4	95.5
35	64	93.5
40.5 (crit. temp.)	80.5	

SOLUBILITY OF CARBON DISULFIDE IN ETHYL ALCOHOL. (Guthrie, 1884.)

Gms. CS_2 per 100 Gms. $CS_2+C_2H_5OH$.	Appearance on Cooling in Ice and Salt Mixture.
94.94	Remains clear down to −18.4
89.54	Becomes turbid at −14.4
84.89	" " " −15.9
79.96	" " " −16.1
65.11	" " " −17.7
59.58	Remains clear down to −20
29.92	" " " " "

CARBON MONOXIDE CO.

SOLUBILITY IN WATER. (Winkler, 1901.)

t°.	β, "Absorp. Coef."	β', "Solubility."	q.	t°.	β, "Absorp. Coef."	β', "Solubility"	q.
0	0.03537	0.03516	0.0044	40	0.01775	0.01647	0.0021
5	0.03149	0.03122	0.0039	50	0.01615	0.01420	0.0018
10	0.02816	0.02782	0.0035	60	0.01488	0.01197	0.0015
15	0.02543	0.02501	0.0031	70	0.01440	0.00998	0.0013
20	0.02319	0.02266	0.0028	80	0.01430	0.00762	0.0010
25	0.02142	0.02076	0.0026	90	0.01420	0.00438	0.0006
30	0.01998	0.01915	0.0024	100	0.01410	0.00000	0.0000

β = vol. of CO absorbed by 1 volume of the liquid at a partial pressure of 760 mm. See p. 227.
β' = vol. of CO (reduced to 0° and 760 mm.) absorbed by 1 volume of the liquid under a total pressure of 760 mm.
q = grams of CO dissolved by 100 grams H_2O at a total pressure of 760 mm.

Solubility of Carbon Monoxide in Water and Aqueous Solutions.

The solubility in water, in terms of the Ostwald solubility expression (see p. 227), was found by Findlay and Creighton (1911) to be l_{25} = 0.0154.

Data for the solubility of CO in water at high pressures are given by Cassuto, 1913.

Data for the solubility of CO in aq. NaOH solutions are given by Fonda, 1910.

Results for the solubility of CO in aq. H_2SO_4 at 20° are given in terms of the Ostwald solubility expression l by Christoff (1906) as follows:
l_{25} for H_2O = 0.02482, l_{25} for 35.82% H_2SO_4 = 0.0114, l_{25} for 61.62% H_2SO_4 = 0.00958, l_{25} for 95.6% H_2SO_4 = 0.02327 and 0.02164.

Data for the solubility of CO in ox blood and ox serum at 25° are given by Findlay and Creighton, 1910–11.

Data for the influence of time on the absorption of CO by blood are given by Grehaut (1894). The author passed air containing from one part CO per 1000 to one part CO per 60,000, through 100 cc. portions of blood and found that the maximum absorption, 18.3 cc. CO per 100 cc. of blood (for the 1 : 1000 mixture) occurred in three hours.

Data for the solubility of CO in aqueous hemoglobin solutions are given by Hüfner (1895) and Hüfner and Kulz (1895).

Solubility of Carbon Monoxide in Aqueous Alcohol Solutions at 20° and 760 mm. Pressure.

(Lubarsch, 1889)

Wt. % Alcohol.	Vol. % Absorbed CO.	Wt % Alcohol.	Vol. % Absorbed CO.
0	2.41	28.57	1.50
9.09	1.87	33.33	1.94
16.67	1.75	50	3.20
23.08	1.68		

Solubility of Carbon Monoxide in Organic Solvents.

(Just, 1901)

Results in terms of the Ostwald Solubility Expression, see p. 227.

Solvent	l_{25}.	l_{20}.	Solvent.	l_{25}.	l_{20}.
Water	0 02404	0.02586	Toluene	0.1808	0.1742
Aniline	0.05358	0 05055	Ethyl Alcohol	0.1921	0.1901
Carbon Disulfide	0.08314	0.08112	Chloroform	0.1954	0.1897
Nitrobenzene	0.09366	0.09105	Methyl Alcohol	0.1955	0.1830
Benzene	0 1707	0.1645	Amyl Acetate	0.2140	0.2108
Acetic Acid	0.1714	0.1689	Acetone	0.2225	0.2128
Amyl Alcohol	0.1714	0.1706	Isobutyl Acetate	0.2365	0.2314
Xylene	0 1781	0.1744	Ethyl Acetate	0.2516	0.2419

100 volumes of petroleum absorb 12.3 vols. CO at 20°, and 13.4 vols. at 10°.
(Gniewosz and Walfisz, 1887.)

Solubility of Carbon Monoxide in Ethyl Ether.

(Christoff, 1912.)

Results in terms of the Ostwald solubility expression, see p. 227.

l_0 = 0.3618. l_{10} = 0.3842.

SOLUBILITY OF CARBON MONOXIDE IN MIXTURES OF ACETIC ACID AND OTHER SOLVENTS AT 25°.

(Skirrow, 1902.)

Results in terms of the Ostwald solubility expression, see p. 227.

Mixture of Acetic Ac. and:	Wt. % CH_3COOH in Mixture.	CO. l_{25}.	Mixture of Acetic Ac. and:	Wt. % CH_3COOH in Mixture.	CO. l_{25}.
Aniline	100	0.173	Chloroform	56.4	0.196
"	86.5	0.110	"	0	0.206
"	58.3	0.070	Nitrobenzene	78.4	0.156
"	17.8	0.058	"	49	0.130
"	0	0.053	"	0	0.093
Benzene	67.5	0.199	Toluene	74.7	0.191
"	33.5	0.198	"	56.9	0.195
"	19.2	0.190	"	20.5	0.190
"	0	0.174	"	0	0.182

SOLUBILITY OF CARBON MONOXIDE IN MIXTURES OF ACETONE AND OTHER SOLVENTS AT 25°.

(Skirrow.)

Mixture of Acetone and:	% $(CH_3)_2CO$ in Mixture. By Wt.	CO. l_{25}.	Mixture of Acetone and:	% $(CH_3)_2CO$ in Mixture. By Wt.	CO. l_{25}.
Aniline	100	0.238	Chloroform	66.6	0.226
"	79.2	0.179	"	26.5	0.212
"	44.9	0.110	"	0	0.207
"	0	0.053	β Naphthol	86	0.190
Carbon Disulfide	82	0.236	"	73.1	0.169
"	50.5	0.227	Nitrobenzene	78.4	0.207
"	26	0.187	"	46.8	0.157
"	14.5	0.144	"	0	0.093
"	0	0.096	Phenanthrene	87.2	0.205
Naphthalene	86.7	0.199	"	75	0.183
"	72.6	0.187			

SOLUBILITY OF CARBON MONOXIDE IN MIXTURES OF BENZENE AND OTHER SOLVENTS AT 25°.

(Skirrow, 1902.)

The solubility of the CO given in terms of the Ostwald expression, see p. 227.

Mixture of Benzene and:	% C_6H_6 in Mixture. By Wt.	CO. l_{25}.	Mixture of Benzene and:	% C_6H_6 in Mixture. By Wt.	CO. l_{25}.
Naphthalene	100	0.174	Aniline	87.3	0.156
"	88.5	0.164	"	71.7	0.131
"	66.2	0.141	"	42.6	0.095
Phenanthrene	89.5	0.144	"	21.2	0.068
"	72.6	0.127	"	0	0.053
α Naphthol	96.5	0.149	Nitrobenzene	71.8	0.152
"	87.9	0.139	"	45.1	0.127
β Naphthol	97.9	0.158	"	0	0.093
"	95.6	0.149	Ethyl Alcohol	47.7	0.181
			"	0	0.192

SOLUBILITY OF CARBON MONOXIDE IN MIXTURES OF TOLUENE AND OTHER SOLVENTS AT 25°.

(Skirrow, 1902.)

Mixture of Toluene and:	$C_6H_5CH_3$ in Mixture. Wt. %.	Mol. %.	CO. l_{25}.	Mixture of Toluene and:	$C_6H_5CH_3$ in Mixture. Wt. %.	Mol. %.	CO. l_{25}.
Aniline	100	100	0.182	α Naphthol	95.5	97.1	0.171
"	93.4	93.5	0.169	"	91.2	94.2	0.162
"	80.1	80.3	0.148	Nitrobenzene	81.7	85.7	0.160
"	55.4	55.6	0.115	"	50.8	58.1	0.131
"	25.4	25.6	0.077	"	23.7	29.3	0.108
"	0	0.	0.053	"	0	0	0.093
Naphthalene	92.9	94.8	0.169	Phenanthrene	94.4	97	0.170
"	84.9	88.7	0.161	"	88.8	93.9	0.161
"	77.3	82 5	0.153	"	78.4	87.5	0.147

SOLUBILITY OF CARBON MONOXIDE IN MIXTURES OF ORGANIC SOLVENTS AT 25°.

(Skirrow.)

Mixture Composed of:	% of Latter in Mixture. By Wt.	By Mol.	CO l_{25}.
Chloroform and Methyl Alcohol	0.0		0.207
" "	13.0		0.202
" "	100		0.196
Carbon Bisulphide and Ethyl Di Chloride		100	0.147
" "		75	0.157
" "		51	0.160
" "		18.4	0.140
" "		0.0	0.083
Methyl Alcohol and Glycerine	0.0	0.0	0.196
" "	39.6	30.1	0.096
" "	60.5	50.1	0.052
" "	77.1	68.9	0.025
" "	100.0	100.0	very small

NOTE. — From the results shown in the preceding five tables, it is concluded that the solubility of carbon monoxide in various mixtures of organic solvents is, in general, an additive function.

CARBON OXYSULFIDE COS.

SOLUBILITY OF CARBON OXYSULFIDE IN WATER.

(Winkler, 1906.)

t°.	β.	q.	t°.	β.	q.
0	1.333	0.356	20	0.561	0.147
5	1.056	0.281	25	0.468	0.122
10	0.836	0.221	30	0.403	0.104
15	0.677	0.179			

For β and q see Carbon Dioxide, p. 227.

SOLUBILITY OF CARBON OXYSULFIDE IN SEVERAL SOLVENTS.

Solvent.	t°.	cc. COS per 100 cc. Solvent.	Authority.
Water	13.5	80	(Hempel, 1901.)
"	20	54	(Stock and Kuss 1917.)
Alcohol	22	800	" "
Toluene	22	1500	" "
HCl solution of CuCl	13.5	20	(Hempel, 1901.)
1 gm. KOH+2cc.H_2O+2cc.C_2H_5OH	13.5	7200	"
Pyridine	...	4.4	"
Nitrobenzene	...	12.0	"

CARBON TETRACHLORIDE CCl_4.

SOLUBILITY IN WATER. (Rex, 1906.)

t°.	0°.	10°	20°	30°
Gms. CCl_4 per 100 gms. H_2O	0.097	0.083	0.080	0.085

RECIPROCAL SOLUBILITY OF CARBON TETRACHLORIDE, ALCOHOL AND WATER.
(Curtis and Titus, 1915)

Alcohol was added from a weight buret to mixtures of weighed amounts of CCl_4 and H_2O, stirred vigorously at 19.75°, until the mixture became homogeneous.

Per cent CCl_4.	Per cent C_2H_5OH.	Per cent H_2O.
41.94	43.19	14.89
33.07	47.68	19.25
25.46	50.50	24.04
17.00	51.95	31.05
14.02	51.56	34.42
10.53	50.97	38.50

In order to determine the effect of temperature upon the mutual solubility, one component was added to a known mixture of the other two, and the critical solubility temperature determined by raising and lowering the temp. through the critical point several times. A further amount of the third component was then added and the critical solubility temperature again determined.

Ratio $\frac{CCl_4}{C_2H_5OH}$ = 0.5048.		Ratio $\frac{CCl_4}{C_2H_5OH}$ = 1.064.		Ratio $\frac{CCl_4}{C_2H_5OH}$ = 2.1012.		Ratio $\frac{CCl_4}{H_2O}$ = 1.0922.	
Per cent H_2O.	Crit. Sol. t°.	Per cent H_2O.	Crit. Sol. t°.	Per cent H_2O.	Crit. Sol. t°.	Per cent C_2H_5OH.	Crit. Sol. t°.
24.25	−1.8	12.47	2.03	6.84	12.7	47.43	44.5
24.61	+3.6	13.95	23.9	7.16	21.55	47.83	39.5
25.13	10.6	14.45	29.8	7.35	27.2	48.6	30.6
25.64	17	14.85	35.4	7.54	31.3	49.61	19.9
26.14	24.5	15.3	39.55	7.84	36.8	50.07	14.6
27.15	31.45	15.67	42.75	8.02	39.75	50.50	9.15
28.52	35.5(?)	16.02	45.5	8.28	44.1	51.06	1.6

The results show that temperature has very little effect on the mutual solubility of the three components. Extensive series of determinations of refractive indices and densities of the mixtures are also given.

Freezing-point data for CCl_4+Cl are given by Waentig and McIntosh (1916).

CARMINE.

100 gms. H_2O	dissolve 0.13 gm. carmine at 20-25°.		(Dehn, 1917.)
" pyridine	" 3.34 gms. " " "		"
" 50% aq. pyridine	" 2.03 " " " "		"

CARVACROL $(CH_3)_2CH.C_6H_3(CH_3)OH$.

MISCIBILITY OF AQ. ALKALINE SOLUTIONS OF CARVACROL WITH SEVERAL ORGANIC COMPOUNDS INSOLUBLE IN WATER. (Sheuble, 1907.)

To 5 cc. portions of aq. KOH solution (250 gms. per liter) were added the given amounts of the aq. insoluble compound from a buret and then the carvacrol, dropwise until solution occurred. Temperature not stated.

Composition of Homogeneous Solutions.		
Aq. KOH.	Aq. Insol. Compd.	Carvacrol.
5 cc.	2 cc. (= 1.64 gms.) Octyl(1) Alcohol	1.8 gms.
5 "	5 cc. (= 4.1 gms.) "	2.6 "
5 "	2 cc. (= 1.74 gms.) Toluene	4 "
5 "	3 cc. (= 2.61 gms.) "	4.8 "
5 "	2 cc. (= 1.36 gms.) Heptane	4.6 "

(1) = the normal secondary octyl alcohol, *i.e.*, the so-called capryl alcohol, $CH_3(CH_2)_5.CH(OH)CH_3$.

CARVOXIME $C_{10}H_4$:NOH *d*, *l* and *i*.

SOLUBILITY IN AQUEOUS ALCOHOL OF $d_{17.5}$ = 0.9125 (51.6 PER CENT C_2H_5OH). (Goldschmidt and Cooper, 1898.)

The determinations were made by the synthetic method. On account of the slow rate at which melted carvoxime solidified on cooling below the melting point, in the tubes containing the synthetic mixtures, it was possible to obtain results which show the solubility curve for liquid carvoxime, in addition to the curves for dextro and inactive carvoxime. The curves for these latter intersect the curve for liquid carvoxime respectively at 51.7°, the m. pt. of dextro, and 70.5° the m.pt. of inactive carvoxime.

Gms. Carvoxime.	Gms. Solvent.	Mols. Carvoxime per 100 Gms. Solvent.	t° of Solution. Solid.	t° of Solution. Liquid.	Solid Phase.
0.0668	1.0868	0.0373	38.4	13.9	*d* Carvoxime
0.1232	1.0830	0.0689	45.8	31.9	"
0.2026	1.0218	0.1202	50.3	49.8	"
0.4040	1.0218	0.2396	...	79.6	"
0.4128	0.8130	0.3077	...	94.5	"
0.0657	1.0980	0.0363	54.2	...	*i* Carvoxime
0.1212	1.0161	0.0723	62.5	33.7	"
0.2715	1.0129	0.1625	69.25	61.3	"
0.3755	1.0384	0.2192	...	76.6	"
0.4496	0.7768	0.3409	...	102.9	"

SOLUBILITY IN *d* LIMONENE. (Goldschmidt and Cooper, 1898.)

t°.	Gms. $C_{10}H_4$.NOH per 100 Gms. *d* Limonene.	Solid Phase.	t°.	Gms. $C_{10}H_4$:NOH per 100 Gms. *d* Limonene.	Solid Phase.
24.6	44.6	*l* Carvoxime	48	198.7	*l* Carvoxime
30	59.2	*l* "	49.4	199.7	*d* "
30.3	63.3	*d* "	55.1	325.1	*l* "
38.4	104.3	*l* "	55.9	346.6	*d* "
39.3	103.1	*d* "	58.8	560	*d* "
43.1	130.8	*l* "	63.2	1269.3	*d* "

Freezing-point data are given for mixtures of *d* and *l* carvoxime by Adriani, 1900 and by Beck, 1904.

CASEIN.

100 gms. H_2O dissolve 2.01 gms. casein at 20–25°. (Dehn, 1917.)
100 gms. pyridine dissolve 0.09 gm. casein at 20–25°. "
100 gms. aq. 50% pyridine dissolve 0.56 gm. casein at 20–25°. "

Data for the solubility of casein in aqueous NaCl solutions are given by Ryd (1917). An abstract of experiments on the solubility of casein in dilute acids is given by Van Slyke and Winter (1913). Results for the solubility of casein in aqueous solutions of KOH, LiOH and $Ca(OH)_2$ at various temperatures, are given by Robertson, 1908.

CATECHOL *o* $C_6H_4(OH)_2$.

Freezing-point data (solubilities, see footnote, p. 1) are given for mixtures of catechol and picric acid, catechol and α naphthylamine and catechol and *p* toluidine by Philip and Smith, 1905.

CEPHAELINE Salts.

SOLUBILITY IN WATER. (Carr and Pyman, 1914.)

Salt.	Formula.	t°.	Gms. Hydrated Salt per 100 cc. Sat. Sol.
Cephaeline Hydrochloride	$C_{28}H_{38}O_4N_2.2HCl.7H_2O$	17–18	26.5
" acid "	$C_{28}H_{38}O_4N_2.5HCl$	18	about 50
" Hydrobromide	$C_{28}H_{38}O_4N_2.2HBr.7H_2O$	17–18	5.4 (dried at 100°)

CERIUM ACETATE, BUTYRATE, FORMATE, etc.

SOLUBILITY IN WATER.

(Wolff — Z. anorg. Chem. 45, 102, '05)

Salt.	Formula.	Grams Anhydrous Salt per 100 Gms. Solution at: 11°.	15°.	76°.
Acetate	$Ce(C_2H_3O_2)_3.1\frac{1}{2}H_2O$	...	19.61	12.97
Butyrate	$Ce(C_4H_7O_2)_3$, and $3H_2O$	3.544	3.406	1.984
Iso Butyrate	$Ce(C_4H_7O_2)_3.3H_2O$	...	6.603(20.4°)	3.39
Formate	$Ce(CHO_2)_3$	...	0.398(13°)	0.374(75.3°)
Propionate	$Ce(C_3H_5O_2)_3.H_2O$, and $3H_2O$	...	18.99	15.93

CERIUM AMMONIUM NITRATE (Ceri) $Ce(NO_3)_4.2NH_4NO_3$.

SOLUBILITY IN WATER.

(Wolff)

t°.	Gms. per 100 Gms. Solution. NH₄.	Ce.	Atomic Relation. NH₄ : Ce.	Gms. $Ce(NO_3)_4.2NH_4NO_3$ per 100 Gms. Solution.	Water.
25	4.065	15.16	2.08 : 1	58 49	140.9
35.2	4.273	16.1c	2.06 : 1	61.79	161.7
45.3	4.489	16.6c	2.08 : 1	64.51	174.9
64.5	4.625	17.40 Ce	2.06 : 1 Ce		
		15.03 Ce IV	2.39 : 1 Ce IV	66.84	201.6
85.6	4.778	18.16 Ce	2.04 : 1 Ce		
		15.79 Ce IV	2 34 : 1 Ce IV	69.40	226.8
112	6.117	22.82 Ce	2.08 : 1 Ce		
		16.22 Ce IV	2.95 : 1 Ce IV	88.03	735.4

CERIUM AMMONIUM NITRATE (Cero) $Ce(NO_3)_3.2NH_4NO_3.4H_2O$.

SOLUBILITY IN WATER.

(Wolff.)

t°.	Gms. per 100 Gms. Solution. NH₄.	Ce.	Atomic Relation. NH₄ : Ce.	Gms. $Ce(NO_3)_3\ 2NH_4NO_3$ per 100 Gms. Solution.	Water.
8.75	4.787	18.56	1.999 : 1	70.2	235.5
25.0	5.09	19.80	1.995 : 1	74.8	296.8
45.0	5.53	21.06	2.037 : 1	80.4	410.2
60.0	6.01	22 77	2.054 : 1	87.2	681.2
65.06	6.11	23.42	2.022 : 1	89.1	817.4

CERIUM AMMONIUM SULPHATE $Ce_2(SO_4)_3.(NH_4)_2SO_4.8H_2O$.

SOLUBILITY IN WATER.

(Wolff.)

t°.	Gms. $Ce_2(SO_4)_3.(NH_4)_2SO_4$ per 100 Gms. Solution.	Water.	Solid Phase.	t°.	Gms. $Ce_2(SO_4)_3.(NH_4)_2SO_4$ per 100 Gms. Solution.	Water.	Solid Phase.
22.3	5.06	5.33	$.8H_2O$	45.0	2.91	2.99	Anhydride
35.1	4.93	5.18	"	55.25	2.16	2.21	"
45.2	4.76	4.99	"	75.4	1.46	1.48	"
				85.2	1.17	1.18	"

CEROUS CHLORIDE $CeCl_3$.

100 cc. anhydrous hydrazine dissolve 3 gms. $CeCl_3$, with evolution of gas, at room temp. (Welsh and Broderson, 1915.)

CERIUM CITRATE $2(CeC_6H_5O_7).7H_2O$.

100 gms. of aq. citric acid solution containing 10 gms. citric acid per 100 cc., dissolve 0.3 gm. $Ce(C_6H_5O_7)$ at 20°. (Holmberg, 1907.)

CERIUM COBALTICYANIDE $Ce_2(CoC_6N_6)_2.9H_2O$.

100 gms. aq. 10% HCl ($d_{15} = 1.05$) dissolve 1.075 gms. of the salt at 25°. (James and Willand, 1916.)

CERIUM FLUORIDE CeF_3.

Freezing-point lowering data are given for mixtures of CeF_3 + KF by Puschin and Baskow, 1913.

CERIUM GLYCOLATE $Ce(C_2H_3O_3)_3$.

One liter H_2O dissolves 3.563 gms. of the salt at 20°. (Jantsch and Grunkraut, 1912-13.)

CERIUM IODATE $Ce(IO_3)_3$.

One liter sat. aqueous solution contains 1.456 gms. $Ce(IO_3)_3$, determined by a chemical method, and 1.636 gms. determined electrolytically. (Rimbach and Schubert, 1909.)

CERIUM MALONATE $Ce_2(C_3H_2O_4)_3 + 6H_2O$.

Solvent.	t°.	Gms. $Ce_2(C_3H_2O_4)_3$ per 100 Grams. Solvent.
Aq. Ammonium Malonate, containing 10 gms. per 100 cc.	20	0.2
Aq. Malonic Acid, containing 20 gms. per 100 cc.	20	0.6

(Holmberg, 1907.)

CERIUM Magnesium, etc., NITRATES.

SOLUBILITY IN CONC. AQ. HNO_3 ($d_{14} = 1.325 = 51.59$ Gms. HNO_3 per 100 cc.) AT 16°.

(Jantsch, 1912.)

Cerium magnesium nitrate, 1 liter sat. solution contains 58.5 gms. $[Ce(NO_3)_6]Mg_3.24H_2O$.
" nickel " " " " 75.3 " " Ni_3 "
" cobalt " " " " 103.3 " " Co_3 "
" zinc " " " " 111.7 " " Zn_3 "
" manganese " " " " 178.8 " " Mn_3 "

CERIUM OXALATE $Ce_2(C_2O_4)_3.9H_2O$.

One liter H_2O dissolves 0.00041 gm. $Ce_2(C_2O_4)_3$ at 25°, determined by the electrolytic method. (Rimbach and Schubert, 1909.)

SOLUBILITY OF CERIUM OXALATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AND OF OXALIC ACID AT 25°.

(Hauser and Wirth, 1908; Wirth, 1912)

Conc. of Aqueous Acid.	Gms. per 100 Gms. Sat Sol CeO_2=	$Ce_2(C_2O_4)_3$.	Solid Phase.	Conc. of Aq. Acid.	Gms. per 100 Gms. Sat. Sol. CeO_2=	$Ce_2(C_2O_4)_3$.	Solid Phase.
0.1*n* H_2SO_4	0.0136	0.0215	$Ce(C_2O_4)_3.9H_2O$	0.1*n* $(COOH)_2$	0.0020	0.0032	$Ce_2(C_2O_4)_3.9H_2O$
0.5 "	0.0524	0.0828	"	0.5 "	0.0083	0.0131	"
1.0 "	0.114	0.1802	"	1.0 "	0.0040	0.0063	"
1.445 "	0.1764	0.2788	"	3.2 " (sat)	0.0019	0.0030	"
2.39 "	0.3083	0.4871	"	0.05 " +.05*n* H_2SO_4	0.0030	0.0047	"
2.9 "	0.4724	0.7467	"	0.05 " +.5 "	0.0025	0.0039	"
3.9 "	0.6300	0.9957	"	0.25 " +.25 "	0.0046	0.0073	"
4.32 "	0.7502	1.1860	"	0.50 " +.05 "	0.0105	0.0166	"
5.3 "	0.9019	1.4250	"	0.50 " +.50 "	0.0010	0.0016	"

CERIUM Dimethyl PHOSPHATE $Ce_2[(CH_3)_2PO_4]_6.H_2O$.

100 gms. H_2O dissolve 79.6 gms. $Ce_2[(CH_3)_2PO_4]_6$ at 25° and about 65 gms. at 95°. (Morgan and James, 1914.)

CERIUM SELENATE $Ce_2(SeO_4)_3.11H_2O$.

SOLUBILITY IN WATER. (Cingolani, 1908.)

t°.	Gms. $Ce_2(SeO_4)_3$ per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. $Ce_2(SeO_4)_3$ per 100 Gms. H_2O.	Solid Phase.
0	39.55	$Ce_2(SeO_4)_3.12H_2O$	60	13.68	$Ce_2(SeO_4)_3.8H_2O$
11.6	37.0	"	60.8	13.12	"
12.6	36.9	$Ce_2(SeO_4)_3.11H_2O$	78.2	5.53	"
26	33.84	"	80.5	4.56	$Ce_2(SeO_4)_3.7H_2O$
28.8	33.22	"	91	2.02	"
34.2	33.15	$Ce_2(SeO_4)_3.10H_2O$	95.4	1.536	$Ce_2(SeO_4)_3.4H_2O$
45	32.16	"	98	1.785	"
45.9	31.89	"	100	2.513	"

CERIUM SULFATE $Ce_2(SO_4)_3$.

SOLUBILITY OF THE SEVERAL HYDRATES IN WATER.

(Koppel, 1904; the previous determinations by Muthman and Rolig, 1898, and by Wyrouboff, 1901, are shown by Koppel to be inaccurate.)

t°.	Gms. $Ce_2(SO_4)_3$ per 100 Gms. Solution.	Mols. $Ce_2(SO_4)_3$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Ce_2(SO_4)_3$ per 100 Gms. Solution.	Mols. $Ce_2(SO_4)_3$ per 100 Mols. H_2O.	Solid Phase.
0	14.20	0.525	$Ce_2(SO_4)_3.12H_2O$	20.5	8.69	0.302	$Ce_2(SO_4)_3.8H_2O$
18.8	14.91	0.555	"	40	5.613	0.188	"
19.2	15.04	0.561	"	60	3.88	0.129	"
0	17.35	0.665	$Ce_2(SO_4)_3.9H_2O$	45	8.116	0.280	$Ce_2(SO_4)_3.5H_2O$
15	10.61	0 376	"	60	3.145	0.103	"
21	8.863	0.308	"	80	1.19	0.0382	"
31.6	6.686	0.227	"	100.5	0.46	0.0149	"
45.6	4.910	0.164	"	35	7.8	0.27	$Ce_2(SO_4)_3.4H_2O$
50	4.465	0.148	"	40	5.71	0.19	"
60	3.73	0.123	"	50	3.31	0.11	"
65	3.47	0.114	"	65	1 85	0.06	"
0	15.95	0.605	$Ce_2(SO_4)_3.8H_2O$	82	0.98	0 032	"
15	9.95	0.350	"	100.5	0.42	0.014	"

SOLUBILITY OF CERIUM SULFATE IN AQUEOUS SOLUTIONS OF ALKALI SULFATES. (Barre, 1910.)

In aq. sols. of K_2SO_4 at 16°. Gms. per 100 Gms. H_2O.		In aq. sols. of Na_2SO_4 at 19°. Gms per 100 Gms H_2O		In aq. sols. of $(NH_4)_2SO_4$ at 16°. Gms per 100 Gms. H_2O.	
K_2SO_4.	$Ce_2(SO_4)_3$.	Na_2SO_4.	$Ce_2(SO_4)_3$.	$(NH_4)_2SO_4$.	$Ce_2(SO_4)_3$.
0	10.747	0	9.648	0	10.747
0.178	0.956	0.328	0.637	3.464	1.026
0.510	0.432	0.684	0.259	9.323	0.782
0.726	0.250	1.091	0.0937	19.240	0.748
1.290	0.042	1.392	0.0570	29.552	0.701
0	6.949 (at 33°)	1.699	0.0303	45.616	0.497
		2.640	0.0120	55.083	0.194
		3.589	0.0065	63.920	0.090
		5.660	0.0046	72.838	0.035
		7.710	0.0037		

The following double salts were found. $Ce_2(SO_4)_3.K_2SO_4.2H_2O$, $2Ce_2(SO_4)_3.3K_2SO_4.8H_2O$, $Ce_2(SO_4)_3.5K_2SO_4$, $Ce_2(SO_4)_3.Na_2SO_4.2H_2O$, $Ce_2(SO_4)_3(NH_4)_2SO_4.8H_2O$ and $Ce_2(SO_4)_3.5(NH_4)_2SO_4$.

SOLUBILITY OF CERIUM SULFATE IN AQ. SOLUTIONS OF SULFURIC ACID AT 25°.
(Wirth, 1912.)

Normality of Aq. H_2SO_4.	Gms. per 100 Gms. Sat. Sol. CeO_2	= $Ce_2(SO_4)_3$.	Solid Phase.	Normality of Aq. H_2SO_4.	Gms. per 100 Gms. Sat. Sol. CeO_2	= $Ce_2(SO_4)_3$.	Solid Phase.
0.0	4.604	7.60	$Ce_2(SO_4)_3.8H_2O$	4.32	2	3.301	$Ce_2(SO_4)_3.8H_2O$
0.1	4.615	7.618	"	6.685	0.9115	1.505	"
1.1	3.64	6	"	9.68	0.4439	0.733	"
2.16	3.04	5.018	"	15.15	0.145	0.239	"

CERIUM SULFONATES.

SOLUBILITY IN WATER. (Holmberg, 1907; Katz and James, 1913.)

Name.	Formula.	t°.	Gms. Anhydrous Salt per 100 Gms. H_2O.
Cerium *m* Nitrobenzene Sulfonate	$Ce[C_6H_4(NO_2)SO_3]_3.6H_2O$	15	25.5
Cerium Bromonitrobenzene Sulfonate	$Ce[C_6H_3Br(NO_2)SO_3 1.4.2]_3.8H_2O$	25	5.89

CERIUM TARTRATE $Ce_2(C_4H_4O_6)_3.4\frac{1}{2}H_2O$, also $6H_2O$.

SOLUBILITY IN WATER (Rimbach and Shubert, 1909, by electrolytic method) AND IN AQ. SOLUTIONS. (Holmberg, 1907)

Solvent.	t°.	Gms. Anhydrous Salt per 100 Gms. Sat. Sol.	Solid Phase.
Water	25	0.005	$Ce_2(C_4H_4O_6)_3.4\frac{1}{2}H_2O$
Aq. Am. Tartrate, 10 Gms. per 100 cc.	20	0.7	$Ce_2(C_4H_4O_6)_3.6H_2O$
Aq. Am. Tartrate, 20 Gms. per 100 cc.	20	2	"
Aq. Tartaric Acid, 20 Gms. per 100 cc.	20	0.4	"
Aq. Tartaric Acid, 40 Gms. per 100 cc.	20	0.2	"

CERIUM TUNGSTATE $Ce_2(WO_4)_3$.

Freezing-point lowering data for mixtures of $Ce_2(WO_3)_3$ and $PbWO_4$ are given by Zambonini, 1913.

CETYL ALCOHOL $C_{16}H_{33}OH$.

100 gms. methyl alcohol dissolve	96.9 gms.	$C_{16}H_{33}OH$	at	23.9°.	(Timofeiew, 1894.)
" ethyl " "	102 2	" "	"	"	"
" " " "	410	" "	"	37	"
" propyl " "	405	" "	"	39	"

CHLORAL HYDRATE $CCl_3.CHO.H_2O$.

SOLUBILITY IN WATER, ETHYL ALCOHOL, CHLOROFORM, AND IN TOLUENE.
(Speyers, 1902.)

Calculated from the original results, which are given in terms of gram molecules of chloral hydrate per 100 gram mols. of solvent.

t°.	In Water. W.	In Water. S.	In Alcohol W.	In Alcohol S.	In Chloroform. W.	In Chloroform. S.	In Toluene. W.	In Toluene. S.
0	1.433	189.7	1.11	123.3	1.530	3.7	0.898	3.2
5	1.460	233.0	1.16	130.0	1.515	4.0	0.900	4.0
10	1.485	275.0	1.23	140.0	1.510	5.0	0.910	7.0
15	1.510	330.0	1.30	160.0	1.505	9.0	0.915	11.0
20	1.535	383.0	1.36	185.0	1.510	19.0	0.94	21.0
25	1.555	433.0	1.42	215.0	1.520	34.0	0.97	36.0
30	1.580	480.0	1.49	245.0	1.540	56.0	1.02	56.0
35	1.59	516.0	1.55	280.0	1.570	80.0	1.13	80.0
40	1.605	...	1.60	320.0	1.590	110.0	1.40	110.0
45	1.620	...	...	...	...	...	...	...

W = wt. of 1 cc. saturated solution, S = Gms. $C_2HCl_3.H_2O$ per 100 grams solvent.

SOLUBILITY IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. $CCl_3COH.H_2O$ per 100 Gms. Solvent.	Solvent.	t°.	Gms. $CCl_3COH.H_2O$ 100 Gms. Solvent.
50% Aq. Pyridine	20–25	374 (Dehn, 1917.)	Ether	ord. t.	200 (Squires.)
Pyridine	20–25	80.9 "	Oil turpentine	cold	10 "
Carbon Disulfide	ord. t.	1.47 (Squires.)		hot	20 "
Glycerol	ord. t.	200 "	Olive Oil	ord. t.	100 "

Freezing-point data (solubility, see footnote, p. 1) are given for mixtures of chloral and water by van Rossem (1908); for mixtures of chloral and ethyl alcohol by Leopold (1909); for mixtures of chloral hydrate and menthol by Pawlewski (1893) and for mixtures of chloral hydrate and salol by Bellucci (1912, 1913).

DISTRIBUTION OF CHLORAL HYDRATE BETWEEN WATER AND ORGANIC SOLVENTS.

Immiscible Solvents.	t.	Dist. Coef. $\frac{\text{Conc. in } H_2O}{\text{Conc in Org. Solvent.}}$	Authority.
Water and Ether	0–30°	0.235	(Hantzsch and Vagt, 1901.)
Water and Benzene	...	...	(Bubanovic, 1913.)
Water and Olive Oil	ord.	4.9	(Baum, 1899)
" " "	30°	4.3	(Meyer, 1901; 1909.)
" " "	3	16.7	(Meyer, 1901.)
" " Toluene	0–20°	58–74.5	(Hantzsch and Vagt, 1901.)

CHLORAL FORMAMIDE $CCl_3.CH(OH).NH.CHO$.

100 gms. H_2O dissolve 5.3 gms. $CCl_3CH(OH).NHCHO$ at 25°. (U. S. P.)
100 gms. 95% alcohol dissolve 77 gms. $CCl_3CH(OH).NHCHO$ at 25°. "

CHLORINE Cl_2.

SOLUBILITY IN WATER.
(Winkler, 1912; Roozeboom, 1884, 1885, 1888)

t°.	β'.	q.	t°.	Gms. Cl per 100 Gms. H_2O.	Solid Phase.
0	4.610	1.46	−0.24	0.492	Ice + Cl.8 aq.
3	3.947	1.25	0	0.507–0.560	Cl.8 aq.
6	3.411	1.08	2	0.644	"
9	3.031	0.96	4	0.732	"
9.6	2.980	0.94	6	0.823	"
12	2.778	0.88	8	0.917	"
10	3.095	0.980	9	0.965–0.908	"
15	2.635	0.835	20	1.85	"
20	2.260	0.716	28.7	3.69	" + 2 layers
25	1.985	0.630			
30	1.769	0.562			
40	1.414	0.451			
50	1.204	0.386			
60	1.006	0.324			
70	0.848	0.274			
80	0.672	0.219			
90	0.380	0.125			
100	0	0			

β' = vol. of Cl (reduced to 0° and 760 mm.) absorbed by 1 vol. H_2O at total pressure of 760 mm.

q = Gms. Cl per 100 gms. H_2O at a total pressure of 760 mm.

The coefficient of solubility of chlorine at 15°, determined by an aspiration method, is given as 51.7 for carbon tetrachloride, 39.6 for acetic anhydride, 36.7 for 99.84% acetic acid, 25.3 for 90 vol. % acetic acid, 16.43 for 75 vol. % acetic acid and 13.43 for 65 vol. % acetic acid. (Jones, 1911.)

Solubility in Water.

(Goodwin, 1882.)

The saturated aqueous solution of the chlorine was cooled until chlorine hydrate separated; the temperature was then gradually raised and portions withdrawn for analysis at intervals. The chlorine was determined by iodometric titration and the results calculated to volume of chlorine dissolved by unit volume of solvent at the given temperature and 760 mm. pressure. Slightly different results were obtained for solutions in contact with much, little, or no chlorine hydrate. The following results are taken from an average curve:

t°.	Solubility Coefficient.	t°.	Solubility Coefficient.	t°.	Solubility Coefficient.
2.5	1.76	11	3	25	2.06
5	2	12.5	2.75	30	1.8
7.5	2.25	15	2.6	40	1.35
10	2.7	20	2.3	50	1

Solubility of Chlorine in Aqueous Solutions of Hydrochloric Acid and of Potassium Chloride.

(Goodwin.)

t°.	Coefficient of Solubility in: HCl. (1.046 Sp. Gr.).	HCl (1.08 Sp. Gr.).	HCl (1.125 Sp. Gr.).	KCl (20 g. per 100 cc.)	Results at 21°. (Mellor, 1901.) Gms HCl per 1000 cc.	Solubility of Cl. (Ostwald l, see p. 227.)
0	4.1	6.4	7.3	1.5	0.	2.2799
5	5.1	5.2	6.7	2	3.134	1.6698
10	4.1	4.5	6.1	2.2	9.402	1.5013
15	3.5	3.9	5.5	1.6	12.540	1.5292
20	3	3.4	4.7	1.2	31.340	1.8033
25	2.5	3	4	1	125.360	2.4473
30	2	2.4	...	0.9	219.380	3.1312
40	1.25	1.6	...	...	313.401	3.8224

Goodwin also gives results for solutions of NaCl, $CaCl_2$, $MgCl_2$, $SrCl_2$, Fe_2Cl_2, $CoCl_2$, $NiCl_2$, $MnCl_2$, $CdCl_2$, LiCl, and in mixtures of some of these, but the concentrations of the salt solutions are not stated.

Solubility of Chlorine in Aqueous Solutions of Sodium Chloride.

(Kumpf, 1882; Kohn and O'Brien, 1898)

t°.	Coefficient of Solubility in: 9.97% NaCl.	16.01% NaCl.	19.66% NaCl.	26.39% NaCl.
0	2.3	1.9	1.7	0.5
5	2	1.6	1.4	0.44
10	1.7	1.3	1.15	0.4
15	1.4	1.06	0.95	0.36
20	1.2	0.9	0.8	0.34
25	0.94	0.75	0.65	0.3
50	...	...	...	0.2
80	...	...	...	0.05

100 cc. of 6.2 per cent $CaCl_2$ solution dissolve 0.245 gm. Cl at 12°.
100 cc. of 6.2 per cent $MgCl_2$ solution dissolve 0.233 gm. Cl at 12°.
100 cc. of 6.2 per cent $MnCl_2$ solution dissolve 0.200 gm. Cl at 12°.
For coefficient of solubility see p. 227.

Freezing-point data (solubility, see footnote, p. 1) are given for the following mixtures containing chlorine.

Chlorine	+ Chloroform	(Waentig and McIntosh, 1916.)
"	+ Ethyl Alcohol	" "
"	+ Methyl Alcohol	" "
"	+ Ethyl Acetate	(Waentig and McIntosh, 1916; Maass and McIntosh, 1912.)
"	+ Methyl Acetate	(Waentig and McIntosh, 1916.)
"	+ Ether	" "
"	+ Hydrochloric Acid	(Maass and McIntosh, 1912.)
"	+ Iodine	(Stortenbecker, 1888, 1889.)
"	+ Sulfur	(Ruff and Fischer, 1903.)
"	+ Sulfur Dioxide	(Smits and Mooy, 1910; Van der Goot, 1913.)
"	+ Sulfuryl Chloride (SO_2Cl_2)	(Van der Goot, 1913)
"	+ " " + Sulfur Dioxide	" "
"	+ Stannic Chloride	(Waentig and McIntosh, 1916.)
"	+ Toluene	(Waentig and McIntosh, 1916; Maass and McIntosh, 1912.)
"	+ Nitrosyl Chloride (NOCl)	(Boubnoff and Guye, 1911.)

Distribution of Chlorine Between CCl_4 and Gaseous Phase and Between CCl_4 and Water.

(Jakowkin, 1899.)

Results for CCl_4 + Gaseous Phase. Millimols Cl per Liter. Gaseous Phase.	CCl_4 Phase.	Results for dist. between CCl_4 and H_2O. 1st Series. Millimols per Liter. H_2O Layer Total Cl.	H_2O Layer Unhydrolized Cl.	CCl_4 Layer.	2nd Series. Millimols per Liter. H_2O Layer Total Cl.	H_2O Layer Unhydrolized Cl.	CCl_4 Layer.
0.1109	8.908	58.21	39.67	803.3	61.73	42.55	864.2
0.2666	22.46	38.36	22.97	464.6	42.62	26.36	335.1
0.5365	44.14	23.08	11.12	222.5	28.98	15.24	311.3
0 8800	75.09	10.10	2.707	52.93	21.70	9.94	202.7

Data for the effect of HCl upon the distribution between H_2O and CCl_4 are also given.

CHLORINE DIOXIDE $ClO_2.8H_2O \pm 1H_2O$.

Solubility in Water.

(Bray, 1905-06.)

t°.	Gms ClO_2 per Liter.	Solid Phase.	t°.	Gms ClO_2 per Liter.	Solid Phase.
−0.79 Eutec.	26.98	$ClO_2.8H_2O$+Ice	15 3	87.04	$ClO_2.8H_2O \pm 1H_2O$
0	27.59	$ClO_2.8H_2O \pm 1H_2O$	10.7 tr. pt.	107.9	" + liquid ClO_2
1	29.48	"	14	more than > 107 9	liquid ClO_2
5.7	42.10	"	10.7	116.7	"
10	60.05	"	1	more than > 108.6	"

The exact composition of the hydrate could not be determined on account of manipulative difficulties.

Data for the distribution of ClO_2 between H_2O and CCl_4 at 0° and 25° are given, also some results showing the effect of H_2SO_4, $KClO_3$ and of KCl on this distribution.

CHLORINE MONOXIDE Cl_2O.

100 volumes of water at 0° absorb 200 volumes of Cl_2O gas.

CHLORINE TRIOXIDE Cl_2O_3.

Solubility in Water at Approx. 760 mm. Pressure.

(Brandan, 1869)

t°.	8.5°.	14°.	21°.	23°.
Gms. Cl_2O_3 per 100 gms. H_2O	4.765	5.012	5.445	5.651

Garzarolli and Thurnbalk, 1881, say that Cl_2O_3 does not exist, and above figures are for mixtures of Cl_2O and Cl.

CHLOROFORM $CHCl_3$.

SOLUBILITY IN WATER.

(Chancel and Parmentier, 1885; Rex, 1906.)

t°.	Gms. $CHCl_3$ per Liter of Solution.	Density of Solutions.	t°.	Gms. $CHCl_3$ per 100 Gms. H_2O (Rex).
0	9.87	1.00378		
3.2	8.90	...	0	1.062
17.4	7.12	1.00284	10	0.895
29.4	7.05	1.00280	20	0.822
41.6	7.12	1.00284	30	0.776
54.9	7.75	1.00309		

100 cc. H_2O dissolve 0.42 cc. $CHCl_3$ at 22°; Vol. of sol. = 100.39 cc., Sp. Gr. = 1.0002.

100 cc. $CHCl_3$ dissolve 0.152 cc. H_2O at 22°; Vol. of sol. = 99.62 cc., Sp. Gr. = 1.4831. (Herz, 1898.)

SOLUBILITY OF CHLOROFORM IN AQUEOUS ETHYL ALCOHOL, METHYL ALCOHOL, AND ACETONE MIXTURES AT 20°.

(Bancroft, 1895)

In Ethyl Alcohol. Per 5 cc. C_2H_5OH. cc. H_2O.	cc. $CHCl_3$.	In Methyl Alcohol. Per 5 cc. CH_3OH cc. H_2O.	cc. $CHCl_3$.	In Acetone. Per 5 cc $(CH_3)_2CO$ cc. H_2O.	cc. $CHCl_3$.
10	0.20	10	0.10	5	0.16
8	0.3	5	0.48	4	0.22
6	0.515	4	0.8	3	0.33
4	1.13	2	4	2	0.58
2	2.51	1.49	7	1	0.955
1	4.60	1.35	8	0.79	1.12
0.91	5	1.12	10	0.505	1.60
0.76	6			0.30	2.50
0.55	8			0.21	3.50
0.425	10			0.19	4
0.20	20			0.16	5
0.125	30.24			0.12	10

Data for the system chloroform, ethyl ether and water are given by Jüttner, 1901.

Experiments by Schachner (1910) show that various fats (olive oil, sheep suet, goose fat) in an atmosphere containing 0.55% $CHCl_3$ vapor, dissolve 0.96–0.98 per cent $CHCl_3$ at 38.5°.

Data for the properties of solutions of $CHCl_3$ in water, saline solution, serum, hemoglobin, etc., in their relation to anesthesia are given by Moore and Roaf, (1904) and Waller (1904–05).

Freezing-point lowering data (solubility, see footnote, p. 1) are given for the following mixtures of chloroform and other compounds.

Mixture.	Authority.
Chloroform + Hydrobromic Acid	(Maass and McIntosh, 1912.)
" + Hydrochloric Acid	(Baume and Borowski, 1914.)
" + Methyl Alcohol	" "
" + Methyl Ether	(Baume, 1914, 1909.)
p nitrophenyl chloroform + *m* nitrophenyl chloroform	(Holleman, 1914.)

CHOLESTEROL $C_{26}H_{43}OH.H_2O$.

100 gms. H_2O	dissolve	0.26 gm. cholesterol at 20–25°.	(Dehn, 1917.)
" pyridine	"	68.10 gms. " " "	"
" 50% aq. pyridine	"	1.10 " " " "	"

100 cc. H_2O dissolve 0.0006 gm. cholesterol-digitonide at b. pt. (Mueller, 1917.)

100 cc. ether dissolve 0.0007 gm. cholesterol-digitonide at room temp. "

Freezing-point lowering data (solubility, see footnote, p. 1) are given for mixtures of cholesterol acetate and phytosterol α and β by Jaeger, 1907. Data for mixtures of cholesterol and oleic acid, cholesterol and palmitic acid and cholesterol and stearic acid are given by Partington, 1911.

SOLUBILITY OF STEARIC ACID ESTER OF CHOLESTEROL IN OILS AT 37° AND VICE VERSA. (Filehne, 1907.)

The determinations were made by adding small weighed amounts of the ester to the oil at 60° and cooling to 36–37° while stirring continually. The additions of the ester were repeated until a clouding just appeared at 36–37°. In the case of the solubility of the oils in cholesterol, the composition of the sat. solution was estimated by means of the specific gravity and the melting point.

Solvent.	t° of Clouding.	Gms. Ester per 100 Gms. Oil.	Solute.	Gms. Oil or Acid per 100 Gms Sat Solution in Ester, Det by: Sp. Gr.	M pt.
Olive Oil	37.6	3.35	Olive Oil	25.5	33.8
Castor Oil	37.6	0.26	Oleic Acid	37	40
Oleic Acid	37.5	4.11	Castor Oil	5	1.85
Ricinic (Oil) Acid	37	0.33	Ricinic Acid	20	16
Pseudo Ricinic Acid	36.2	0.85	Pseudo Ricinic Acid	10	12
Crotonic (Oil) Acid	36.5	0.87	Crotonic Acid	(5)	5

CHOLINE PERCHLORATE and its Nitric Ether.

100 gms. H_2O dissolve about 290 gms. $(CH_3)_3N(ClO_4)CH_2CH_2.OH$ at 15°.
100 gms. H_2O dissolve 0.62 gm. $(CH_3)_3N(ClO_4)CH_2.CH_2.ONO_2$ at 15°.
100 gms. H_2O dissolve 0.82 gm. " at 20°. (Hofmann and Höbold, 1911.)

CHROMIUM ALUMS.

SOLUBILITY OF CHROMIUM ALUMS IN WATER AT 25°. (Locke, 1901.)

Alum.	Formula.	Per 100 cc Water. Grams Anhydrous.	Grams Hydrated.	Gram Mols.
Potassium Chromium Alum	$K_2Cr_2(SO_4)_4.24H_2O$	12.51	24.39	0.0441
Tellurium Chromium Alum	$Te_2Cr_2(SO_4)_4.24H_2O$	10.41	16.38	0.0212

CHROMIUM CHLORIDES $CrCl_3.6H_2O$.

SOLUBILITY OF THE GREEN AND THE VIOLET MODIFICATIONS IN WATER AT 25°. (Olie Jr, 1906)

The solubility of hydrated chromium chloride depends upon the inner composition of the solution, that is, the relative amounts of the green and the violet modification of the salt present in the saturated solution. These are determined by precipitating with silver nitrate. A freshly prepared solution of the green chloride yields only one-third of its chlorine in the cold, hence the composition of this modification, according to Werner, is represented by the formula $[Cr(H_2O)_4Cl_2]Cl.2H_2O$. The violet chloride is considered to have the composition, $[Cr(H_2O)_6]Cl_3$. A determination of the amount of each present involves precipitating one portion of the solution at 0° with silver nitrate and another portion (for total Cl) at the boiling point. Experiments were first made with aqueous solutions of different percentage composition of the two modifications. These were agitated at 25° and analyzed at intervals until equilibrium was reached. The time for equilibrium varied from 18 to 40 days according to the concentrations present. The effect of temperature and of the presence of HCl on the transition of the green chloride was also studied.

The equilibrium in saturated solutions at 25° was determined by rubbing the hydrated chromium chloride with a little water previously cooled to 0° to a thin mush. This was then agitated at 25° and portions removed at successive intervals of time and analyzed. The results show the total chloride and per cent present as the green modification.

25 Gms. Green Salt + 10 Gms. H_2O. Time of Agitation.	Gms. $CrCl_3$ per 100 Gms. Sat. Sol.	Per cent of Green Salt.	25 Gms. Violet Salt + 10 Gms. H_2O. Time of Agitation.	Gms. $CrCl_3$ per 100 Gms. Sat Sol.	Per cent of Green Salt.	25 Gms. Violet Salt + 10 cc. of 35% Sol. of the Green Salt. Time of Agitation.	Gms $CrCl_3$ per 100 Gms. Sat Sol.	Per cent of Green Salt.
¼ hr.	58.36	91.7	⅙ hr.	61.99	1 53	1⅙ hr.	65.49	15.95
4 hrs.	63.27	75.2	1 day	63.88	8 46	2 days	70.47	26.81
1 day	68.50	62 36	4 days	70 68	30 89	5 "	76 38	39 34
3 days	68.95	57.22	7 "	72.11	37.28	8 "	73 26	34.20
19 days	68.58	57.38	26 "	70 62	51 54	12 "	71.14	58.60

In a later paper Olie Jr. (1907) gives additional results at 29°, 32° and 35°.

100 cc. anhydr. hydrazine dissolve 13 gms. $CrCl_3$ at room temp. (Welsh & Broderson, '15.)

CHROMIUM TRIOXIDE CrO_3.

SOLUBILITY IN WATER.

(Büchner, and Prins, 1912–13; Kremann, Daimer and Bennesch, 1911; Koppel and Blumenthal, 1907; and Mylius and Funk, 1900.)

t°.	Gms. CrO_3 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. CrO_3 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. CrO_3 per 100 Gms. Sat. Sol.	Solid Phase.
− 0.9	3.6	Ice	− 43.5	49.1	Ice	50	64.55	CrO_3
− 1.9	7.8	"	− 60	53.3	"	65	64.83	"
− 3.7	11.5	"	−155	60.5	" + CrO_3	82	66	"
− 4.8	14.1	"	− 20	61.7	CrO_3	90	68.5	"
−10.95	24.9	"	0	62.24	"	100	67.4	"
−11.7	25.2	"	+ 18	62.45	"	115	68.4	"
−18.75	33.5	"	24.8	62.88	"	122	70.7	"
−25.25	39.2	"	40	63.50		193–196	100	decomposition

Density of solution sat. at 18° = 1.705.

100 cc. anhydrous hydrazine dissolve 1 gm. CrO_3 with evolution of gas and production of a black precipitate at room temp. (Welsh and Broderson, 1915.)

CHROMIUM DOUBLE SALTS.

SOLUBILITY IN WATER.

(Jörgensen, 1879, 1884, 1890; Struve, 1899.)

Name of Salt.	Formula.	t°.	Gms. per 100 Gms. H_2O.
Chlorotetraamine Chromium Chloride	$CrCl(NH_3)_4(OH_2)Cl_2$	15	6.3
Chloropurpureo Chromium Chloride	$CrCl(NH_3)_5Cl_2$	16	0.65
Luteo Chromium Nitrate	$Cr(NH_3)_6(NO_3)_3$	?	2.6
Chloropurpureo Chromium Nitrate	$CrCl(NH_3)_5(NO_3)_2$	17.5	1.4
Chromic Potassium Molybdate	$3K_2O.Cr_2O_3.12MoO_3.20H_2O$	17	2.5

CHROMIUM SULFATES (ous and ic).

SOLUBILITY IN WATER.

Salt.	Gms. per 100 Gms. H_2O.	Solid Phase.	Authority.
Chromous	12.35 (at 0°)	$CrSO_4.7H_2O$	(Moissan, 1882.)
Chromic	120 (at ?°)	$Cr_2(SO_4)_3.18H_2O$	(Etard, 1877.)

CHROMIUM THIOCYANATE $Cr(CNS)_3$.

Data for the distribution of $Cr(CNS)_3$ between water and ether at 0°–30° are given by Hantzsch and Vagt, 1901.

CHRYSAROBIN $C_{30}H_{26}O_7$.

SOLUBILITY IN SEVERAL SOLVENTS.

(U. S. P.)

Solvent.	Gms. per 100 Gms. Solvent at: 25°.	80°.
Water	0.021	0.046
Alcohol	0.324	0.363 (60°)
Benzene	4	...

Solvent.	Gms. per 100 Gms. Solvent at 25°.
Chloroform	5.55
Ether	c.873
Amyl Alcohol	3.33
Carbon Disulfide	0.43

CHRYSENE $C_{18}H_{12}$.

SOLUBILITY IN TOLUENE AND IN ABS. ALCOHOL.

(v. Becchi.)

100 gms. toluene dissolve 0.24 gm. $C_{18}H_{12}$ at 18°, and 5.39 gms. at 100°.

100 gms. abs. alcohol dissolve 0.097 gm. $C_{18}H_{12}$ at 16°, and 0.170 gm. at boiling point.

CINEOLE (Eucalyptole) $C_{10}H_{18}O$.

Freezing-point lowering data (solubility, see footnote, p. 1) for mixtures of cineole and each of the following compounds are given by Bellucci and Grassi, (1913); phenol, α and β naphthol, *o*, *m* and *p* cresol, *o*, *m* and *p* nitrophenol, *o*, *m* amidophenol, pyrocatechol, resorcinol, hydroquinone, guaiacol, *o*, *m* and *p* oxybenzoic acid, methyl salicylate, phenyl salicylate, naphthalene and thymol.

CINCHONA ALKALOIDS.

SOLUBILITY OF CINCHONINE, CINCHONIDINE, QUININE, AND QUINIDINE IN SEVERAL SOLVENTS. (Müller, 1903; see also Prunier, 1879.)

Solvent.	Grams of the Alkaloid per 100 Grams Solution.				
	Cinchonine $C_{19}H_{22}N_2O$.	Cinchonidine $C_{19}H_{22}N_2O$.	Quinine $C_{20}H_{24}N_2O_2$. Hydrate.	Quinine Anhydride.	Quinidine $C_{20}H_{24}N_2O_2$.
Ether	0.10	0.211	1.619	0.876	0.776
Ether sat. with H_2O	0.123	0.523	5.618	2.794	1.629
H_2O sat. with Ether	0.025	0.0306	0.0667	0.0847	0.031
Benzene	0.0545	0.099	0.2054	1.700	2.451
Chloroform	0.6979	9.301	100+	100+	100+
Acetic Ether	0.0719	0.3003	4.65	2.469	1.761
Petroleum Ether	0.0335	0.0475	0.0103	0.0211	0.0241
Carbon Tetra Chloride	0.0361	0.0508	0.203	0.529	0.565
Water	0.0239	0.0255	0.574	0.0506	0.0202
Glycerine (15.5°)	0.50		0.50	...	...

SOLUBILITY OF CINCHONINE AND CINCHONIDINE IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms Alkaloid per 100 Gms Solvent Cinchonine.	Cinchonidine.	Authority.
Water	ord. temp.	0.0043	...	(Hatcher, 1902.)
"	20	0.0131	...	(Scholtz, 1912.)
"	25	0.0113	0.021	(Schaefer, 1910.)
Aq. 10% Ammonia	20	0.025	...	(Scholtz, 1912.)
Aq. 85% C_2H_5OH+10% Am.	20	0.41	...	"
Aniline	20	1.6	...	"
Pyridine	20	1.4	7.78	(Scholtz, 1912; Dehn, 1917.)
50% Aq. Pyridine	20–25	...	10	(Dehn, 1917.)
Aq. 85% C_2H_5OH (d_{20}=0.832)	20	0.86	...	(Scholtz, 1912.)
C_2H_5OH (95%)	20	0.80	5	(Wherry and Yanovsky, 1918.)
C_2H_5OH (prob. 92.3 wt. %)	25	0.62	5.1	(Schaefer, 1913.)
Abs. C_2H_5OH	19	0.874	...	(Timofeiew, 1894.)
Abs. C_2H_5OH	25	0.89	...	(Sill, 1905.)
Benzene	25	0.057	0.127	(Schaefer, 1913.)
Acetone	25	0.091	...	(Sill, 1905.)
Chloroform	17	0.014	...	(Oudemans, 1872.)
"	25	0.606	19	(Schaefer, 1913.)
"	50	0.565	...	(Köhler, 1879.)
Ether	25	0.055	...	(Sill, 1905.)
"	32	0.264	...	(Köhler, 1879.)
Isoamyl Alcohol	25	1.10	...	(Sill, 1905.)
Isobutyl Alcohol	19	1.09	...	(Timofeiew, 1894.)
Methyl Alcohol	25	0.785–1.17	7.39	(Schaefer, 1913; Sill, 1905.)
Piperidine	20	3.5	...	(Scholtz, 1912.)
Diethyl Amine	20	1.3	...	"

Results for the solubility of cinchonine and cinchonidine in mixtures of ethyl and methyl alcohols with benzene and with chloroform are given by Schaefer (1913).

It is pointed out by Schaefer (1910), that if the saturated solution is analyzed by shaking out with chloroform or ether, variable results, depending on the age and method of manufacture of the alkaloid, will be obtained.

Except in the case of the results by Sill in the above table, the saturated solutions were obtained by agitating at intervals, instead of constantly at the given temperature.

SOLUBILITY OF CINCHONINE, CINCHONIDINE AND CINCHOTINE SALTS IN WATER.

Salt.	t°.	Gms. per 100 Gms. H_2O. Cinchonine Salt.	Cinchonidine Salt.	Cinchotine Salt.	Authority.
Hydrobromide	25	1.7	1.66	...	(Schaefer, 1910.)
Bihydrobromide	25	55.5	14.3	...	"
Hydrochloride	25	4.5[1]	4.8[2]	2.12[3]	(Schaefer, 1910; Forst and Böhringer, 1881.)
Bihydrochloride	25	...	62.5	...	(Schaefer, 1910.)
Sulfate	25	1.17[4]	1.08[5]	3.28[6]	(Schaefer, 1910; Forst and Böhringer, 1881.)
Sulfate	80	3.1	4.8	...	(U. S. P.)
Bisulfate	25	66.6	100	...	(Schaefer, 1910.)
Perchlorate	12	0.3(solvent = aq. 6% $HClO_4$)			(Hofmann, Roth, Höbold and Metzler, 1910.)
Salicylate	25	0.17	0.075	...	(Schaefer, 1910.)
Tannate	25	0.091	0.055	...	"
Tartrate	25	3.12[7]	...	1.76[8]	(Schaefer, 1910; Forst and Böhringer, 1881.)
Bitartrate	16	0.99	...	1.28	(Forst and Böhringer, 1881.)
Oxalate	20	0.96	...	1.16	" "

[1] 4.16 at 10°. [2] 4 at 15°. [3] at 10°. [4] 1.52 at 13°. [5] 1 at 15°. [6] at 13°. [7] 3 at 16°. [8] at 16°.

SOLUBILITY OF CINCHONINE SULFATE AND OF CINCHONIDINE SULFATE IN ALCOHOL AND OTHER SOLVENTS.

Solvent.	t°.	Gms. per 100 Gms Solvent. $(C_{19}H_{22}N_2O)_2 \cdot H_2SO_4 \cdot 2H_2O$.	$(C_{19}H_{22}N_2O)_2 \cdot H_2SO_4 \cdot 3H_2O$.	Authority.
Ethyl Alcohol (92.3 wt. %)	25	9.8 (10)	0.85 (1.4)	(Schaefer, 1913; U. S. P.)
" " "	60	... (19 2)	... (3.1)	(U. S. P.)
Methyl Alcohol	25	83.9	35.9	(Schaefer, 1913; U. S. P.)
Chloroform	25	0.66 (1.45)	0.1 (0.11)	(Schaefer, 1913; U. S. P.)
Ether	25	0.04	0.02	(U. S. P.)
Glycerol	15	6.7	...	

Results for mixtures of alcohol, chloroform and benzene are given by Schaefer, '13.

Very carefully determined data for the solubility of *Cinchonine* in ethyl alcohol, methyl alcohol, amyl alcohol and acetone solutions of various concentrations of a large number of organic acids and of phenols are given by Sill, 1905.

CINNAMIC ACID $C_6H_5CH:CH.COOH$.

100 gms. H_2O dissolve 0.0495 gm. $C_6H_5CH:CHCOOH$ at 25°. (De Jong, 1909.)

100 gms. H_2O dissolve 0.0607 gm. $C_6H_5CH:CHCOOH$ at 25°. (Sidgwick, 1910.)

100 cc. 0.5 *n* sodium cinnamate solution dissolve 0.155 gm. $C_6H_5CH:CHCOOH$ at 25° (Sidgwick, 1910)

100 cc. sat. sol. in petroleum ether (b. pt. 30°–70°) contain 0.095 gm. $C_6H_5CH:CH.COOH$ at 26°.

100 cc. sat. sol. in carbon tetrachloride contain 2.172 gms. $C_6H_5CH:CH.COOH$ at 26°. (De Jong, 1909.)

100 cc. sat. sol. in 95% formic acid contain 3.76 gms. $C_6H_5CH:CH.COOH$ at 20°. (Aschan, 1913.)

SOLUBILITY OF CINNAMIC ACID (Melting point, 133°) IN ALCOHOLS. (Timofeiew, 1894.)

t°.	Gms. Cinnamic Acid per 100 Gms. Sat. Solution in: CH_3OH.	C_2H_5OH.	C_3H_7OH.	$(CH_3)_2CH.CH_2OH$.
−18	8.1	6.74	4.3	...
−12.5	9.3	8	5.5	...
0	13	11.3	8.2	...
+19.5	22.5	18.1	13.4	8.6

SOLUBILITY OF CINNAMIC ACID IN ORGANIC SOLVENTS AT 25°. (Herz and Rathmann, 1913.)

Solvent.	Gms. $C_6H_5CH:CHCOOH$ per 100 cc. Sat. Sol.	Solvent. $CHCl_3$	CCl_4	Gms. $C_6H_5CH:CHCOOH$ per 100 cc. Sat. Sol.	Solvent. C_2HCl_3	C_2HCl_4	Gms. $C_6H_5CH:CH\text{-}COOH$ per 100 cc. Sat. Sol.
Chloroform	12.09	100 cc.	+ 0 cc.	12.09	100 cc.	+ 0 cc.	6.04
Carbontetrachloride	1.75	80 "	+ 20 "	9.86	80 "	+ 20 "	5.91
Trichlorethylene	6.04	50 "	+ 50 "	6.61	50 "	+ 50 "	5.85
Tetrachlorethylene	2.55	33.3 "	+ 66.6 "	4.50	33.3 "	+ 66.6 "	5.82
Tetrachlorethane	11.05	20 "	+ 80 "	3.32	20 "	+ 80 "	5.70
Pentachlorethane	5.54	0 "	+ 100 "	1.75	0 "	+ 100 "	5.54

CINNAMIC ACID $C_6H_5CH:CH.COOH$.

SOLUBILITY OF CINNAMIC ACID IN AQUEOUS SOLUTIONS OF SODIUM ACETATE, BUTYRATE, FORMATE, AND SALICYLATE AT 26.4°.
(Philip — J Chem. Soc. 87, 992, '05.)

Calculated from the original results, which are given in terms of molecular quantities per liter.

Gms. Na Salt per Liter.	Gms. $C_6H_5CH:CH.COOH$ per Liter in Solutions of:			
	CH_3COONa.	C_3H_7COONa.	$HCOONa$.	$C_6H_4.OH.COONa$.
0	0.56	0.56	0.56	0.56
1	1.50	1.30	0 92	0.62
2	2.12	1.85	1 12	0.70
3	2.52	2.25	1.27	0.73
4	2.85	2.60	1.40	0.77
5	3.05	2.90	1.47	0.80
8	...	...	...	0.90

1 liter of aqueous solution contains 0.491 gm. $C_6H_5CH:CH.COOH$ at 25° (Paul).

SOLUBILITY OF CINNAMIC ACID IN AQUEOUS SOLUTIONS OF ANILIN AND OF PARA TOLUIDIN AT 25°.
(Lowenherz — Z. physik. Chem. 25, 394, '98.)

Original results in terms of molecular quantities per liter.

In Aqueous Anilin. Grams per Liter.		In Aqueous p Toluidin. Grams per Liter.	
$C_6H_5NH_2$.	$C_6H_5CH:CHCOOH$.	$C_6H_4CH_3NH_2$.	$C_6H_5CH:CHCOOH$.
0	0.49	0	0.49
1	1.20	1	1.52
2	1.65	2	2.20
3	2.02	3	2.83
4	2.35	4	3.35
6	2.92	5	3.80

Freezing-point data for mixtures of cinnamic acid and dimethylpyrone and for hydrocinnamic acid and dimethylpyrone are given by Kendall, 1914.

BromoCINNAMIC ACIDS.

SOLUBILITY OF α AND OF β BROMOCINNAMIC ACIDS IN WATER AT 25°.
(Paul, 1894.)

Acid.	Per 1000 cc Sat. Solution. Gms.	Millimols.
α $C_6H_5CH:CBrCOOH$	3.9325	17.32
β $C_6H_5CBr:CHCOOH$	0.5255	2.315

SOLUBILITY OF α ISO BROMOCINNAMIC ACID IN AQUEOUS SOLUTIONS OF OXANILIC ACID (Melting point = 120°) AT 25°.
(Noyes, 1890.)

Normality of Solutions.		Grams per Liter.	
$C_6H_5NHCO-COOH$.	$C_6H_5CH-CBrCOOH$.	$C_6H_5NHCO-COOH$.	$C_6H_5CH-CBrCOOH$.
0	0.0176	0	3.995
0.0275	0.0140	4.54	3.178
0.0524	0.0129	8.65	2.928

Allo **CINNAMIC ACIDS** (Unstable Isomers of Cinnamic Acid).

SOLUBILITY OF EACH OF THE THREE ISOMERIC ALLOCINNAMIC ACIDS AND OF THE MELTS OF THE THREE ISOMERS IN WATER.

(Meyer, 1911.)

Results for:

Allocinnamic Acid of M. pt. 68°.		Allocinnamic Acid of M. pt. 58°. (Natural Isocinnamic Acid.)		Allocinnamic Acid of M. pt. 42°. (Artificial Isocinnamic Acid.)		Melted Allocinnamic Acid.	
t°.	Gms. Acid per Liter.	t°.	Gms. Acid per Liter.	t°.	Gms. Acid per Liter.	t°.	Gms. Acid per Liter
18	6.88	18	7.62	18	8.95	18	13.63
25	8.45	25	9.37	25	11.03	25	14.44
35	11.14	35	12.39	35	14.61	35	16.05
45	14.46	45	16.09			45	18.11
55	18.45					55	20.55
						65	23.43
						75	27.69

These curves intersect that for the melted acid at the melting points of the solid isomers.

The results show that the three isomers are polymorphic modifications of the *cis* acid.

100 gms. ligroïn (b. pt. 60–70°) dissolve more than 16 gms. isocinnamic acid. (Liebermann, 1903.)

100 gms. ligroïn (b. pt. 60–70°) dissolve approx. 2 gms. allocinnamic acid. "

SOLUBILITY OF α CHLOROCINNAMIC ACID, ETC., IN BENZENE.

(Stoermer and Heymann, 1913.)

Name of Compound.	M. pt.	t°.	Gms. Cmpd per 100 Gms. C_6H_6.	Name of Compound.	M. pt.	t°.	Gms. Cmpd. per 100 Gms. C_6H_6
α Chlor-cinnamic Acid	137	20	2 6	β Brom-cinnamic Acid	135	13	1.58
Allo α "	111	21	11	Allo β "	159.5	14	0 86
α Brom- "	131	20	5.17	*cis* Dichlor- "	121	13	6 1
Allo α "	120	18.5	6 9	*trans* "	101	14	21.2
β Chlor- "	142	17	1 94	*cis* Dibrom- "	100	14	26.9
Allo β "	132	16	3.17	*trans* "	136	14	10.6

FREEZING-POINT DATA (Solubility, see footnote, p. 1) FOR MIXTURES OF CINNAMIC ACID AND OTHER COMPOUNDS, AND OF CINNAMIC ACID DERIVATIVES AND OTHER COMPOUNDS.

Cinnamic Acid + Phenylpropionic Acid (Bruni and Gorni, 1899)
p Methoxycinnamic Acid + Hydroquinone (de Kock, 1904.)
α Monochlorcinnamic Aldehyde + α Monobromcinnamic Aldehyde (Küster, 1891.)
Cinnamylidine + Diphenylbutadiene (Pascal, 1914.)
" + Diphenyldiacetylene "

CITRIC ACID $(CH_2)_2COH(COOH)_3.H_2O$.

SOLUBILITY OF HYDRATED AND OF ANHYDROUS CITRIC ACID, DETERMINED SEPARATELY, IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°.

(Seidell, 1910)

Results for Hydrated Citric Acid.			Results for Anhydrous Citric Acid.		
Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $(CH_2)_2COH(COOH)_3.H_2O$ per 100 Gms. Sat. Solution.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms $(CH_2)_2COH(COOH)_3$ per 100 Gms. Sat. Solution.
0	1.311	67.5	20	1.297	62.3
20	1.286	66	40	1.246	59
40	1.257	64.3	60	1.190	54.8
50	1.237	63.3	70	1.160	52.2
60	1.216	62	80	1.120	48.5
70	1.192	60.8*	90	1.065	43.7
80	1.163	58.1*	100	1.010	38.3
90	1.125	54.7*			
100	1.068	49.8*			

* Solid phase dehydrated more or less completely.

SOLUBILITY OF HYDRATED AND OF ANHYDROUS CITRIC ACID, DETERMINED SEPARATELY, IN SEVERAL ORGANIC ACIDS AT 25°. (Seidell, 1910.)

Results for Hydrated Citric Acid.			Results for Anhydrous Citric Acid.		
Solvent.	d_{25} of Sat. Sol.	Gms. $(CH_2)_2COH(COOH)_3.H_2O$ per 100 Gms. Sat. Sol.	Solvent.	d_{25} of Sat. Sol.	Gms. $(CH_2)_2COH(COOH)_3$ per 100 Gms. Sat. Sol.
Amyl Acetate of d_{20}=0.8750	0.8917	5.980	Amyl Acetate	0.8861	4.22
Amyl Alcohol of d_{20}=0.8170	0.8774	15.430	Ether (abs.)	0.7160	1.05
Ethyl Acetate of d_{25}=0.8915	0.9175	5 276	Chloroform	1.4880	0
Ether (abs.) of d_{22}=0.7110	0.7228	2.174	C_6H_6, CS_2		
Chloroform of d_{22}=1.476	1.4850	0.007	CCl_4 or $C_6H_5CH_3$	...	0

100 gms. 95% formic acid dissolve 12.25 gms. citric acid at 20°. (Aschan, 1913.)
100 gms. dichlorethylene dissolve 0 005 gm. citric acid at 15°. (Wester & Bruins, '14)
" trichlorethylene " 0.012 " " " " " " "
" methyl alcohol " 197 gms. " " " 19°. (Timofeiew, 1914)
" propyl alcohol " 62 8 " " " " " "

DISTRIBUTION OF CITRIC ACID BETWEEN WATER AND ETHER. (Pinnow, 1915.)

Results at 15°.			Results at 25.5°.		
Mols. Citric Acid per Liter			Mols. Citric Acid per Liter.		
In H_2O Layer.	In Ether Layer.	Dist. Coef.	In H_2O Layer.	In Ether Layer.	Dist Coef.
0.902	0.0077	117	0.9175	0.0063	114
0.460	0.0036	128	0.481	0.0031	155
0.220	0.0017	129	0.241	0.00155	155
0.297	0.0023	129	0.315	0.0020	158

COBALT AMINES.

SOLUBILITY IN WATER AT ORDINARY TEMPERATURE. (Lal De, 1917.)

Name of Isomeride.	Formula.	Gms. Isomeride per liter Sat. Sol.
Triamine Cobalt Nitrate	$[(NH_3)_3Co(NO_2)_3]$	2.882
1.2 Dinitrotetraamine cobaltitetranitrodiamine cobaltiate	$\left[Co\begin{matrix}(NO_2)_2\\(NH_3)_4\end{matrix}\right]^{I}-\left[Co\begin{matrix}(NO_2)_4\\(NH_3)_2\end{matrix}\right]^{I}$	3.68
1.6 Dinitrotetraamine cobaltitetranitrodiamine cobaltiate	" "	0.398
Hexa-amine cobaltihexanitrocobaltiate	$[Co(NH_3)_6]^{III}-[Co(NO_2)_6]^{III}$	0.0215

COBALT DOUBLE SALTS.

SOLUBILITY IN WATER.

(Jörgensen — J. pr. Chem. [2] 18, 205, '78; 19, 49, '79; Kurnakoff — J. russ. phys. chem. Ges. 24, 629, '92.)

Name.	Formula.	t°.	Gms. Salt per 100 Gms. H_2O.
Chloro purpureo cobaltic bromide	$CoCl(NH_3)_5Br_2$	14.3	0.467
Bromo purpureo cobaltic bromide	$CoBr(NH_3)_5Br_2$	16	0.19
Chloro tetra amine cobaltic chloride	$CoCl(NH_3)_4(OH_2)Cl_2$		2.50
Chloro purpureo cobaltic chloride	$CoCl(NH_3)_5Cl_2$	0	0.232
Chloro purpureo cobaltic chloride	$CoCl(NH_3)_5Cl_2$	15.5	0.41
Chloro purpureo cobaltic chloride	$CoCl(NH_3)_5Cl_2$	46 6	1.03
Luteo cobaltic chloride	$Co(NH_3)_6Cl_3$	0	4.26
Luteo cobaltic chloride	$Co(NH_3)_6Cl_3$	46.6	12.74
Roseo cobaltic chloride	$Co(NH_3)_5(OH_2)Cl_3$	0	16.12
Roseo cobaltic chloride	$Co(NH_3)_5(OH_2)Cl_3$	16.2	24.87
Chloro purpureo cobaltic iodide	$CoCl(NH_3)_5I_2$	19.2	2.0
Chloro purpureo cobaltic nitrate	$CoCl(NH_3)_5(NO_3)_2$	15	1.25
Chloro purpureo cobaltic sulphate	$CoCl(NH_3)_5SO_4.2H_2O$	17.3	0.75
Nitrato purpureo cobaltic nitrate	$Co(NO_3)(NH_3)(NO_3)_2$	16	0.36

COBALT ACETATE $Co(CH_3COO)_2$.

100 cc. anhydrous hydrazine dissolve 1 gm. cobalt acetate with evolution of gas at room temp. (Welsh and Broderson, 1915.)

COBALT BROMIDE $CoBr_2$.

SOLUBILITY IN WATER.
(Etard, 1894.)

t°.	59°.	75°.	97°.
Gms. $CoBr_2$ per 100 gms. solution	66 7	66.8	68.1 (blue)

100 gms. methyl acetate (d_{18} = 0.935) dissolve 10.3 gms. $CoBr_2$ at 18°, d_{18} of sat. solution = 1.013. (Naumann, 1909.)

COBALT CHLORATE $Co(ClO_3)_2$.

SOLUBILITY IN WATER.
(Meusser, 1902.)

t°.	Gms. $Co(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Co(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Co(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Co(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.
−12	29.97	3.41	Ice	18	64.19	14.28	$Co(ClO_3)_2.4H_2O$
−21	53.30	9.08	$Co(ClO_3)_2.6H_2O$	21	64.39	14.51	"
−19	53.61	9.20	"	35	67.09	16.10	"
0	57.45	10.75	"	47	69.66	18.29	"
10.5	61.83	12.90	"	61	76.12	25.39	"

Density of solution saturated at 18° = 1.861.

COBALT PerCHLORATE $Co(ClO_4)_2.9H_2O$.

SOLUBILITY IN WATER.
(Goldblum and Terlikowski, 1912.)

t°.	Gms. $Co(ClO_4)_2$ per 100 Gms. H_2O.	Solid Phase.	t°.	Density Sat. Sol.	Gms. $Co(ClO_4)_2$ per 100 Gms. H_2O.	Solid Phase.
−10.9	32.67	Ice	0	1.564	100	$Co(ClO_4)_2.5H_2O$
−30.7	58.16	"	7.5	1.566	101.9	"
−62.2 Eutec.	...	Ice+$Co(ClO_4)_2.9H_2O$	18	1 567	103.8	"
−30.7	83.2	$Co(ClO_4)_2.9H_2O$	26	1.581	113.4	"
−21.3	90.6	"	45	1.588	115	"

COBALT CHLORIDE $CoCl_2$.

SOLUBILITY IN WATER.
(Etard — Compt. rend. 113, 699, '91; Ann. chim. phys. [7] 2, 537, '94.)

t°.	Gms. $CoCl_2$ per 100 Gms. Solution.	Solid Phase.	t°.	Gms. $CoCl_2$ per 100 Gms. Solution.	Solid Phase.
−10	27.0	$CoCl_2.6H_2O$ (red)	35	38.0	$CoCl_2.H_2O$ (violet)
0	29.5	"	40	41.0	"
+10	31.5	"	50	47.0	"
20	33.5	"	60	47.5	$CoCl_2.H_2O$ (blue)
25	34.5	"	80	49.5	"
30	35.5	"	100	51.0	"

SOLUBILITY OF COBALT AMMONIUM CHLORIDES IN WATER.
(Kurnakoff — J. russ. phys. chem. Ges. 24, 629, '93; J. Chem. Soc. 64, ii, 509, '93.)

Salt.	Grams per 100 Grams H_2O at: 0°.	16.9°.	46.6°.
$CoCl_3.5NH_3$	0.232	...	1.031
$CoCl_3.5NH_3.H_2O$	16.12	24.87	...
$CoCl_3.6NH_3$	4.26	...	12.74

Solubility of Cobalt Chloride in Aqueous Hydrochloric Acid Solutions at 0°.

(Engel — Ann. chim. phys. [6] 7, 355, '89.)

Milligram Mols. per 10 cc. Sol. $\frac{1}{2}CoCl_2$.	HCl.	Sp. Gr. of Solutions.	Gms. per 100 Gms. Solution. $CoCl_2$.	HCl.	Gms. per 100 cc. Solution. $CoCl_2$.	HCl.
62.4	0	1.343	30.17	0.00	40.5	0
58.52	3.7	1.328	28.62	0.102	38.0	0.135
50.8	11.45	1.299	25.39	0.321	33.0	0.417
37.25	25.2	1.248	19.43	0.738	24.2	0.919
12.85	55.0	1.167	7.15	1.718	8.34	2.00
4.75	74.75	1.150	2.68	2.369	3.08	2.72
12.0	104.5	1.229	6.34	3.099	7.79	3.81
25.0	139.0	1.323	12.27	3.829	16.24	5.07

Solubility of Cobalt Chloride in Aqueous Alcohol at 11.5°.

(Bödtker — Z. physik. Chem. 22, 509, '97.)

10 gms. of $CoCl_2.6H_2O$ were added to 20 cc. of alcohol and in addition the amounts of $CoCl_2$ shown in the second column. The solutions were shaken 2 hours, 5 cc. withdrawn, and the amount of dissolved $CoCl_2$ determined by evaporation and weighing.

Vol. % Alcohol.	Gms. $CoCl_2$ Added.	Gms. per 5 cc. Solution. H_2O.	$CoCl_2$.	Vol. % Alcohol.	Gms. $CoCl_2$ Added.	Gms. per 5 cc. Sol. H_2O.	$CoCl_2$.
91.3	0.0	1.325	1.168	99.3	0.612	0.764	1.459
98.3	0.0	1.134	1.214	99.3	0.813	0.688	1.568
98.3	0.0	1.068	1.181	99.3	1.022	0.634	1.713
99.3	0.0	1.045	1.199	99.3	1.240	0.553	1.831
99.3	0.194	0.899	1.204	99.3	1.446	0.483	1.943
99.3	0.400	0.829	1.325	99.3	1.650	0.500	2.183

100 gms. sat. solution in alcohol (0.792 Sp. Gr.) contain 23.66 gms. $CoCl_2$, Sp. Gr. = 1.0107. (Winkler — J. pr. Chem. 91, 207, '64.)

Solubility of Cobalt Chloride in Organic Solvents.

Solvent.	t°.	Gms per 100 Gms. Solvent. $CoCl_2$.	$CoCl_2.2H_2O$	Authority.
Acetone	0	9.11	17.16	(von Laszczynski, 1894.)
"	22.5	9.28	17.06	(von Laszczynski, 1894.)
"	25	8.62	...	(Krug and McElroy, 1892.)
"	18	2.75	...	(Naumann, 1904.)
Ethyl Acetate	14	0.08	...	(von Laszczynski, 1894.)
" "	79	0.26	...	"
Ether, Abs.	...	0.021	0.291	(Bödtker, 1897.)
Glycol	...	10.7(per 100 g. sol.)		(de Coninck, 1905.)
Acetonitrile	18	4.08	...	(Naumann and Schier, 1914.)
Methyl Acetate	18	0.369*	...	(Naumann, 1909.)
95% Formic Acid	20.5	6.2	...	(Aschan, 1913.)
Anhy. Hydrazine	±15	1	...	(Welsh and Broderson, 1915.)

* d_{18} sat. sol. = 0.938.

SOLUBILITY OF COBALT CHLORIDE IN PYRIDINE.
(Pearce and Moore, 1913.)

t°.	Gm $CoCl_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gm. $CoCl_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gm. $CoCl_2$ per 100 Gms. Sat. Sol.	Solid Phase.
−48.2	0	C_5H_5N	34.6	0.749	1.4	74.8	2.037	1.2
−50.3 Eutec.	...	" + 1.6	37.6	0.754	"	78.2	2.276	"
−45	0.4185	1.6	44.6	0.950	"	79.8	2.428	"
−30	0.4205	"	47.2	1.020	"	88	3.284	"
−19.6	0.4208	"	51	1.110	"	90 tr. pt.	...	" + $CoCl_2$
−10	0.4310	"	55	1.192	"	96.5	7.251	$CoCl_2$
0	0.4307	"	60	1.324	"	98.8	7.936	"
15 tr. pt.	...	1.6+1.4	64.2	1.460	"	106	12.540	"
23	0.569	1.4	68	1.572	"	110	14.165	"
25	0.575	"	70 tr. pt	...	" + 1.2			

1.6 = $CoCl_2.6C_5H_5N$. 1.4 = $CoCl_2.4C_5H_5N$. 1.2 = $CoCl_2.2C_5H_5N$.

COBALT CITRATES.

SOLUBILITY IN WATER.
(Pickering, 1915.)

Salt.	Formula.	t°.	Gms. per 100 cc. Sat. Sol. Co =	Salt (anhydrous).
Cobalt Citrate (normal)	$Co_3[(COO.CH_2)_2C(OH)COO]_2.2H_2O$	10	0.08	0.267
Cobalt Hydrogen Citrate	$CoH[(COO.CH_2)_2C(OH)COO]$	10	0.20	0.906
Cobalt Potassium Citrate	$KCo[(COO.CH_2)_2C(OH)COO].4H_2O$	10	1.05	5.11
Cobalt Potassium Citrate	$K_4Co[(COO.CH_2)_2C(OH)COO]_2$	10	3.04	31

COBALT FLUORIDE $CoF_2.4H_2O$.

100 gms. sat. solution in water contain 2.23 gms. of cobalt fluoride of α variety.
100 gms. sat. solution in water contain 2.32 gms. of cobalt fluoride of β variety.
(Costachescu, 1910.)

COBALT IODATE $Co(IO_3)_2$.

SOLUBILITY IN WATER.
(Meusser — Ber. 34, 2435, '01.)

t°.	Solid Phase: $Co(IO_3)_2.4H_2O$. G.	M.	$Co(IO_3)_2.2H_2O$. G.	M.	$Co(IO_3)_2$. G.	M.
0	0.54	0.028	0.32	0.014	...	...
18	0.83	0.038	0.45	0.020	1.03	0.046
30	1.03	0.046	0.52	0.023	0.89	0.040
50	1.46	0.065	0.67	0.030	0.85	0.030
60	1.86	0.084	...	...	...	...
65	2.17	0.098	...	...	...	...
75	...	...	0.84	0.038	0.75	0.033
100	...	...	1.02	0.045	0.69	0.031

G = Gms. $Co(IO_3)_2$ per 100 gms. solution. M = Mols. $Co(IO_3)_2$ per 100 Mols. H_2O.

COBALT IODIDE CoI_2.

SOLUBILITY IN WATER.
(Etard — Compt. rend. 113, 699, '91; Ann. chim. phys. [7] 2, 537, '94.)

The accuracy of these results is doubtful.

t°.	Gms. CoI_2 per 100 Gms. Solution.	Solid Phase.	t°.	Gms. CoI_2 per 100 Gms. Solution.	Solid Phase.
−10	55.5	$CoI_2.H_2O$ (green)	25	67.5	$CoI_2.H_2O$ (olive)
0	58.0	"	30	70.0	"
10	61.5	"	40	75.0	$CoI_2.H_2O$ (yellow)
15	63.2	"	50	79.0	"
20	65.2	"	80	80.0	"
25	67	"	110	81.0	"

COBALT MALATE $Co(COO.CH_2.CHOHCOO).2H_2O$.

100 cc. sat. solution in water contain 0.14 gm. Co = 0.453 gm. anhydrous salt at 10°. (Pickering, 1915.)

COBALT MALONATES.

SOLUBILITY OF COBALT MALONATES IN WATER.
(Lord, 1907.)

Salt.	Formula.	t°.	Gms. Anhydrous Salt per 100 Gms. Sat. Sol.
Cobalt Malonate	$CoCH_2(COO)_2.2H_2O$	18	1.353
" Ammonium Malonate	$Co(NH_4)_2[CH_2(COO)_2]_2.4H_2O$	18	10.61
" Caesium "	$CoCs_2[CH_2(COO)_2]_2.4H_2O$	18	14.23
" Potassium "	$CoK_2[CH_2(COO)_2]_2.4H_2O$	18	4.26

COBALT NITRATE $Co(NO_3)_2$.

SOLUBILITY IN WATER.
(Funk — Wiss. Abh. p. t. Reichanstalt 3, 439, '00.)

t°	Gms. $Co(NO_3)_2$ per 100 Gms. Solution.	Mols. $Co(NO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Co(NO_3)_2$ per 100 Gms. Solution.	Mols. $Co(NO_3)_2$ per 100 Mols. H_2O.	Solid Phase
−26	39.45	6.40	$Co(NO_3)_2.9H_2O$	41	55.96	12.5	$Co(NO_3)_2.6H_2O$
−20.5	42.77	7.35	"	56	62.88	16.7	"
−21	41.55	6.98	$Co(NO_3)_2.6H_2O$	55	61.74	15.8	$Co(NO_3)_2.3H_2O$
−10	43.69	7.64	"	62	62.88	16.7	"
− 4	44.85	7.99	"	70	64.89	18.2	"
0	45.66	8.26	"	84	68 84	21.7	"
+18	49.73	9.71		91	77 21	33.3	"

Density of solution saturated at 18° = 1.575.

SOLUBILITY OF COBALT NITRATE IN GLYCOL.
(de Coninck, 1905)

100 grams saturated solution contain 80 gms. cobalt nitrate.

COBALT RUBIDIUM NITRITE $Rb_3Co(NO_2)_6.H_2O$.

100 gms. H_2O dissolve 0.005 gm. of the salt. (Rosenbladt, 1886.)

COBALT OXALATE $Co(COO)_2$.

100 gms. 95% formic acid dissolve 0.04 gm. $Co(COO)_2$ at 19.8°. (Aschan, 1913.)

COBALT SULFATE $CoSO_4.7H_2O$.

SOLUBILITY IN WATER.
(Mulder; Tobler, 1855; Koppel, Wetzel, 1905)

t°.	Gms. $CoSO_4$ per 100 Gms. Solution.	Gms. $CoSO_4$ per 100 Gms. Water.	Mols. $CoSO_4$ per 100 Mols. H_2O	t°.	Gms $CoSO_4$ per 100 Gms Solution.	Gms $CoSO_4$ per 100 Gms Water.	Mols. $CoSO_4$ per 100 Mols. H_2O.
0	20.35	25.55	2.958	35	31.40	45.80	5.31
5	21.90	28.03	3.251	40	32.81	48.85	5.664
10	23.40	30.55	3.540	50	35.56	55.2	...
15	24.83	33.05	3.831	60	37.65	60.4	...
20	26.58	36.21	4.199	70	39.66	65.7	...
25	28.24	39.37	4.560	80	41.18	70	...
30	29.70	42.26	4.903	100	45.35	83	...

100 gms. H_2O dissolve 37.8 gms. $CoSO_4$ at 25°. (Wagner, 1910.)

Freezing-point data (solubility, see footnote, p. 1) for mixtures of $CoSO_4$ + Li_2SO_4, $CoSO_4$ + K_2SO_4 and $CoSO_4$ + Na_2SO_4 are given by Calcagni and Marotta (1913).

SOLUBILITY OF MIXTURES OF $CoSO_4.7H_2O$ AND $Na_2SO_4.10H_2O$ IN WATER.

(Koppel; Wetzel.)

t°.	Gms. per 100 Gms. Solution.		Gms. per 100 Gms. H_2O.		Mols. per 100 Mols. H_2O.		Solid Phase.
	$CoSO_4$.	Na_2SO_4.	$CoSO_4$.	Na_2SO_4.	$CoSO_4$.	Na_2SO_4.	
0	16.56	7.63	21.85	10.07	2.54	1.27	$CoSO_4.7H_2O$ + $Na_2SO_4.10H_2O$
5	17.46	9.59	23.94	13.15	2.77	1.67	"
10	17.90	11.73	25.41	16.67	2.94	2.11	"
20	17.59	16.43	26.65	24.91	3.09	3.15	$CoNa_2(SO_4)_2.4H_2O$
25	17.06	15.70	25.36	23.32	2.95	2.97	"
30	15.94	14.93	23.15	21.61	2.70	2.74	"
35	15.73	14.52	22.54	20.85	2.62	2.64	"
40	14.87	14.22	20.98	20.05	2.46	2.53	"
18.5	18.75	15.61	28.61	23.82	3.32	3.02	$CoNa_2(SO_4)_2.4H_2O$ + $CoSO_4.7H_2O$
20	19.30	15.10	29.42	23.01	3.41	2.92	"
25	20.30	13.60	30.74	20.58	3.56	2.61	"
30	21.67	12.05	32.70	18 17	3 79	2.30	"
35	22.76	10 43	34.06	15.61	3.95	1.98	"
40	24.05	9.16	35.01	13.72	4.81	1.74	"
18.5	16.87	16.97	25.50	25 65	2.96	3.25	$CoNa_2(SO_4)_2.4H_2O$ + $Na_2SO_4.10H_2O$
20	15.41	18.12	23.18	27.26	2.69	3.45	"
25	10.63	23.26	16.07	35.17	1 86	4.46	"
30	6.01	28.67	9.20	43.74	1.07	5.54	"
35	4.56	32.14	7.19	50.79	0 835	6.44	$CoNa_2(SO_4)_2.4H_2O$ + Na_2SO_4
40	4.72	31.78	7.45	50.10	0.864	6.34	"

SOLUBILITY OF COBALT SULPHATE IN METHYL AND ETHYL ALCOHOL AND IN GLYCOL.

Solvent.	t°.	Gms. per 100 Gms. Solvent		Observer.
		$CoSO_4$.	$CoSO_4.7H_2O$.	
Methyl Alcohol (abs.)	3	...	42.8	(de Bruyn—Z. physik. Ch. 10, 784, '92.)
" "	15	...	50 9	"
" "	18	1.04	54 5	"
" (93.5%)	3	...	13.3	"
" (50%)	3	...	1.8	"
Ethyl Alcohol (abs.)	3	...	2.5	"
Glycol	..	(per 100 gms. solution)	3.1	(de Coninck—Bull. acad. roy. Belgique, 359, '05.)

COBALT SULFIDE CoS.

One liter water dissolves 0.00379 gm. CoS at 18° (electrolytic conductivity method, assuming complete dissociation and hydrolysis). (Weigel, 1906.)

COCAINE $C_{17}H_{21}NO_4$.

SOLUBILITY IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. $C_{17}H_{21}NO_4$ per 100 Gms. Solvent.	Authority.
Water	20	0.028	(Zalai, 1910.)
"	±20	0.140	(Baroni and Barlinetti, 1911.)
"	25	0.17	(U. S. P.)
"	80	0 38	"
3 Gms. H_3BO_3 in Aq. 50% Glycerol	±20	8	(Baroni and Barlinetti, 1911.)
Alcohol (92.5 Wt. %)	25	20	(U. S. P)
Ether	25	26.3	"
"	18–22	11.6	(Müller, 1903.)
Ether sat. with H_2O	18–22	34	"
Water sat. with Ether	18–22	0.254	"
Aniline	20	76	(Scholtz, 1912)
Carbon Tetrachloride	20	31 94	(Gori, 1913)
Chloroform	18–22	100+	(Müller, 1903)
Benzene	18–22	100	"
Ethyl Acetate	18–22	59	"
Petroleum Ether	18–22	2 37	"
Pyridine	20–25	80+	(Dehn, 1917; Scholtz, 1912.)
Piperidine	20	56	(Scholtz, 1912.)
Diethylamine	20	36	"
Sesame Oil	20	4 34*	(Zalai, 1910.)
Olive Oil	25	8 3	(U. S. P.)
Oil of Turpentine	25	7.1	"

* Per 100 cc.

COCAINE HYDROCHLORIDE $C_{17}H_{21}NO_4.HCl$.

100 gms. H_2O dissolve 250 gms. of the salt at 25° and 1000 gms. at 80°. (U. S P.)
100 gms. 92.3% alcohol dissolve 38 gms. salt at 25° and 71 gms. at 60°. (U S. P.)
100 gms. chloroform dissolve 5.4 gms. salt at 25°. (U. S. P.)
100 gms. glycerol dissolve 25 gms. salt at 15°. (B. P.)

COCAINE PERCHLORATE $C_{17}H_{21}NO_4.HClO_4$.

100 gms. H_2O (containing 8% free $HClO_4$) dissolve 0.26 gm. perchlorate at 6°. (Hofmann, Roth, Hobold and Metzler, 1910.)

CODEINE $C_{18}H_{21}NO_3.H_2O$.

CODEINE PHOSPHATE $C_{18}H_{21}NO_3.H_3PO_4.2H_2O$.

CODEINE SULFATE $(C_{18}H_{21}NO_3)_2.H_2SO_4.5H_2O$.

SOLUBILITY OF EACH SEPARATELY IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms per 100 Gms Solvent: Codeine.	C. Phosphate.	C. Sulfate.	Authority.
Water	25	0.80–1.7	44.9	3.3	(U. S. P; Baroni and Barlinetto, 1911.)
"	20	0.84	..	..	(Zalai 1910)
"	80	1.70	227	16	(U. S. P.)
Alcohol (92.3 Wt. %)	25	63.7	0 383	0.1	(Schaeffer, 1913; U. S. P.)
" "	60	108.7	1.03	0.27	(U S. P)
Methyl Alcohol	25	62.8	...	0.56	(Schaeffer, 1913)
Chloroform	25	133–151	0.015	0 007	(Schaeffer, U S. P.)
Carbon Tetrachloride	20	2.94–1.33	...	...	(Gori, 1913, Beilstein, Suppl.)
Ether	25	8	0.075	.	(U. S. P)
Benzene	25	11.4	...	Insol.	(Schaeffer, 1913)
Trichlorethylene	15	12	...	.	(Wester and Bruins, 1914.)
3 Gms. H_3BO_3 per 100 cc. aq. 50% Glycerol	ord. t.	4	...	...	(Baroni and Barlinetto, 1911.)

100 gms. trichlorethylene dissolve 0.014 gm. codeine hydrochloride at 15°. (Wester and Bruins, 1914.)

Data for the solubility of codeine and codeine sulfate in mixtures of alcohols, benzene and chloroform are given by Schaeffer (1913).

COLCHICINE $C_{22}H_{25}NO_6$.

SOLUBILITY IN SEVERAL SOLVENTS.
(Müller, 1903; U. S. P.)

Solvent.	t°.	Gms. $C_{22}H_{25}NO_6$ per 100 Gms. Solvent.	Solvent.	t°.	Gms. $C_{22}H_{25}NO_6$ per 100 Gms. Solvent.
Water	18–22	9.6	Water sat. with Ether	18–22	12.05
"	25	4.5	Benzene	18–22	0.94
"	80	5	Benzene	25	1.15
"	82	13.7*	Chloroform	18–22	100+
Ether	18–22	0.13	Carbon Tetrachloride	18–22	0.12
"	25	0.64	Ethyl Acetate	18–22	1.34
" sat. with H_2O	18–22	0.18	Petroleum Ether	18–22	0.06

* Beilstein.

COLCHICINE SALTS.

Name.	Formula.	Solvent.	t°.	Gms. Salt per Liter Sat Sol.	Authority.
Colchicine Iodohydrate	$C_{22}H_{25}NO_6.HI$	Water	30	0.84	(Pfannl, 1911.)
Iso Colchicine Iodohydrate	"	"	30	3 86	"
Colchicine Silicotungstate	$(C_{22}H_{25}NO_6)_5SiO_2.12WO_3.2H_2O$	"	15	0.083	(Jensen, 1913.)
		Aq. 1% HCl	15	0.007	"

COLLIDINE (2.4.6 Trimethyl Pyridine) $C_5H_2N(CH_3)_3$.

SOLUBILITY IN WATER.
(Rothmund, 1898.)

t°.	Gms. Collidine per 100 Gms. Aq. Layer.	Collidine Layer.	t°.	Gms. Collidine per 100 Gms. Aq. Layer.	Collidine Layer.
5.7 crit. t.	17.20		80	1.73	86.12
10	7.82	41.66	100	1.78	88.07
20	3.42	54.92	120	1.82	88.98
30	2.51	62.80	140	2.19	89.10
40	1.93	70.03	160	2.93	87.2
60	1.76	80.19	180	3.67	...

COLLIDINE (1.3.5 Trimethyl Pyridine) $C_5H_2N(CH_3)_3$.

DISTRIBUTION BETWEEN WATER AND TOLUENE.
(Hantzsch and Vagt, 1901)

t°.	G Mols. Collidine per Liter. H_2O Layer.	Toluene Layer.	Dist. Coef.	t°.	G Mols. Collidine per Liter. H_2O Layer	Toluene Layer	Dist. Coef.
0	0.0035	0.0580	0.0603	50	0.0017	0.0596	0.0285
10	0.0026	0.0587	0.0443	70	0.0015	0.0597	0.0251
20	0.0022	0.0588	0.0374	90	0.0013	0.0598	0.0218
30	0.0020	0.0594	0.0337				

CONGO RED $[C_6H_4.N:N.C_{10}H_5(NH_2)SO_3Na]_2$.

100 gms. H_2O dissolve 11.6 gms. congo red at 20°–25°. (Dehn, 1917.)
100 gms. pyridine dissolve 0.29 gm. congo red at 20°–25°. "
100 gms. aq. 50% pyridine dissolve 7.32 gms. congo red at 20–25°. "

CONIINE (αPropyl Piperidine) $C_8H_{17}N$.

100 gms. H_2O dissolve 1.83 gms. coniine at 20°. (Zalai, 1910.)

COPPER ACETATE $Cu(C_2H_3O_2)_2H_2O$.

100 gms. glycerol (d_{15} = 1.256 = 96%) dissolve 10 gms. copper acetate at 15°–16°. (Ossendowski, 1907.)

SOLUBILITY OF ANHYDROUS COPPER ACETATE IN PYRIDINE.
(Mathews and Benger, 1914.)

t°.	Gms. $Cu(C_2H_3O_2)_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $Cu(C_2H_3O_2)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
−11.6	0.37	$Cu(C_2H_3O_2)_2.4C_5H_5N$	45.2	4.17	$Cu(C_2H_3O_2)_2.4C_5H_5N$
+2	0.6	"	34.8	3.75	$Cu(C_2H_3O_2)_2.C_5H_5N$
13	1.03	"	55.7	4.13	"
26.45	1.61	"	64.3	4.48	"
37.4	2.83	"	76.2	4.83	"
41.9	3.12	"	83.3	5.40	"
43.2	3.39	"	95.4	6.31	"

Transition point = 44.7°.

COPPER BROMIDE (ous) Cu_2Br_2.

SOLUBILITY OF CUPROUS BROMIDE IN AQUEOUS SOLUTIONS OF POTASSIUM BROMIDE AT 18°–20°.
(Bodlander and Storbeck, 1902.)

Millimols per Liter.					Grams per Liter.			
KBr.	Total Cu	Total Br	Cu (ic)	Cu (ous).	KBr.	Total Cu	Cu (ic).	Cu (ous).
0	0.3157	0.4320	0.2096	0.1061	0	0.0201	0.0133	0.0067
25	0.119	...	0.012	0.107	2.98	0.0076	0.0007	0.0068
40	0.200	...	0.013	0.187	4.76	0.0127	0.0007	0.0119
60	0.310	...	0.025	0.285	7.15	0.0197	0.0015	0.0181
80	0.423	...	0.012	0.411	9.53	0.0266	0.0007	0.0261
100	0.584	...	...	0.584	11.91	0.0371	...	0.0371
120	0.693	...	...	0.693	14.29	0.0441	...	0.0441
500	8.719	...	...	8.719	59.55	0.5540	...	0.5540

100 gms. acetonitrile dissolve 3.86 gms. Cu_2Br_2 at 18°. (Naumann and Schier, 1914.)

Freezing-point lowering data for mixture of CuBr + KBr are given by de Cesaris, 1911.

COPPER BROMIDE (ic) $CuBr_2$.

100 gms. acetonitrile dissolve 24.43 gms. $CuBr_2$ at 18°. (Naumann and Schier, 1914.)
100 gms. 95% formic acid dissolve 0.16 gm. $CuBr_2$ at 21°. (Aschan, 1913.)

COPPER CARBONATE Basic.

SOLUBILITY IN AQUEOUS CO_2 SOLUTIONS AT 30°.
(Free, 1908.)

Aq. 0.5 *n* Na_2CO_3 and 0.5 *n* $CuSO_4$ were mixed and the precipitate washed and suspended in H_2O containing CO_2 at a pressure slightly above atmospheric, for 3 days. The filtered precipitate was kept in water ready for use. In the fresh condition or dried, the molecular ratio of the constituents was found to be 1CuO: 0.515 CO_2: 0.61 H_2O. For the solubility determinations, about 2 gms. of the precipitate were suspended in 600 cc. of H_2O and CO_2 passed in to the desired concentration. The mixture was shaken frequently for 3 days. The total CO_2 in the sat. solution was determined and the free CO_2 calc. by difference, assuming that the amount combined to the Cu was in the molecular ratio 2CuO:1CO_2.

Parts per Million.		Parts per Million.	
Free CO_2.	Metallic Cu.	Free CO_2	Metallic Cu.
0 = pure H_2O	1.5	859	28
157	8.3	961	31
277	13.7	1158	33.7
348	17	1224	34.8
743	25.7	1268–1549	35.3–39.7*

* Saturated with CO_2 at 1 + atmosphere

Results practically identical with the above were obtained for a NaCl solution containing 100 parts per million. Data for other concentrations of NaCl and for other salts are also given. Salts with a common ion depress the solubility. Those with no common ion increase it slightly. A recalculation of the results of Free is given by Seyler (1908).

SOLUBILITY OF MIXTURES OF COPPER CARBONATE AND POTASSIUM CARBONATE IN WATER AT 25°.

(Wood and Jones, 1907–08.)

100 gms. H_2O dissolve 3.15 gms. $CuCO_3$ + 105 gms. K_2CO_3 at 25° when the solid phase in contact with the solution is $CuCO_3.K_2CO_3$ + K_2CO_3.

Additional points on the curves were determined but the analytical data are not given. The following approximate values were read from the curve for the double salt, $CuCO_3.K_2CO_3$:

Gms per 100 Gms. H_2O. K_2CO_3.	$CuCO_3$.	Solid Phase.
105	3.15	K_2CO_3+$CuCO_3.K_2CO_3$
100	3.20	$CuCO_3.K_2CO_3$
90	3.40	"
85	3.60	"

The triple point for double salt + $CuCO_3$ could not be determined since $CuCO_3$ is not capable of existing alone and decomposes into CO_2 + $Cu(OH)_2$.

COPPER CHLORATE (ic) $Cu(ClO_3)_2.4H_2O$.

SOLUBILITY IN WATER.

(Meusser, 1902.)

t°.	Gms. $Cu(ClO_3)_2$ per 100 Gms. Solutions.	Mols. $Cu(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Cu(ClO_3)_2$ per 100 Gms. Solutions.	Mols. $Cu(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.
−12	30.53	3.43	Ice	18	62.17	12.84	$Cu(ClO_3)_2.4H_2O$
−31	54.59	9.39	$Cu(ClO_3)_2.4H_2O$	45	66.17	15 28	"
−21	57.12	10.41	"	59.6	69.42	17.73	"
+ 0.8	58.51	11.02	"	71	76.9	25.57	"

Density of solution saturated at 18° = 1.695.

COPPER CHLORIDE (ic) $CuCl_2.2H_2O$.

SOLUBILITY IN WATER.

(Reicher and Deventer, 1890; see also Etard, 1894.)

t°.	Gms. $CuCl_2$ per 100 Gms. Solution.	t°	Gms. $CuCl_2$ per 100 Gms. Solution.	t°.	Gms. $CuCl_2$ per 100 Gms. Solution.
−40 Eutec.	36.3	20	43.5	50	46.65
0	41.4	25	44	60	47.7
10	42.45	30	44.55	80	49.8
17	43.06	40	45.6	100	51.9

Density of solution saturated at 0° = 1.511, at 17.5° = 1.579.

100 gms. sat. solution in water contain 43.95 gms. $CuCl_2$ at 30°, solid phase, $CuCl_2.2H_2O$. (Schreinemakers, 1910.)

COPPER CHLORIDE (ous) CuCl.

100 gms. H_2O dissolve 1.52 gms. CuCl at 25°. (Noss, 1912.)

SOLUBILITY OF CUPROUS CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID CONTAINING $CuCl_2$ AT 25°.

(Poma, 1909, 1910.)

Results for 1 *n* HCl. Mols. per Liter. $CuCl_2$ Added.	$CuCl_2$+CuCl.	Solid Phase.	Results for 2 *n* HCl. Mols. per Liter. $CuCl_2$ Added.	$CuCl_2$+CuCl.	Solid Phase.	Results for 4 *n* HCl. Mols. per Liter. $CuCl_2$ Added.	$CuCl_2$+CuCl.	Solid Phase.
0	0.0862	CuCl	0	0.2365	CuCl	0	0.7704	CuCl
0.1	0.2017	"	0.094	0.3528	"	0.095	0.9044	"
0.2	0.3256	"	0.188	0.4766	"	0.189	1.0370	"
0.4	0.5707	"	0.235	0.5385	"	0.379	1.3040	"
0.5	0.6924	"	0.282	0.6038	"	0.473	1.4380	"

SOLUBILITY OF CUPROUS CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID.

(Engel — *Ibid.* [6] 17, 372, '89; Compt. rend. 121, 529, '95.)

Milligram Mols. per 10 cc. Sol. $\frac{1}{2}Cu_2Cl_2$.	Milligram Mols. per 10 cc. Sol. HCl.	Sp. Gr. of Solutions.	Gms. per 100 cc. Sol. Cu_2Cl_2.	Gms. per 100 cc. Sol. HCl.	Gms. per 100 Gms. Sol. Cu_2Cl_2.	Gms. per 100 Gms. Sol. HCl.
Results at 0°.						
0.475	8.975	1.05	0.471	0.327	0.448	0.312
1.5	17.5	1.049	1.486	0.638	1 418	0 608
2.9	26.0	1.065	2.872	0.948	2.697	0.932
4.5	34.5	1.080	4.457	1.257	4.127	1.164
8.25	47.8	1.135	8.172	1.743	7.199	1.535
15.5	68.5	1.261	15.7	2.497	12.46	1.980
33.0	104.0	1.345	32.68	3.827	24.30	2.845
Results at 15°-16°.						
7.4	54.4	1.19	7.33	1.983	6.159	1.666
10.8	68.9	1.27	10.69	2.511	8.422	1.977
12.8	75.0	1.29	12 68	2.734	9.826	2.119
16 0	92.0	1.38	15.84	3.346	11.48	2.424

SOLUBILITY OF CUPRIC CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 0°.

(Engel — Ann. chim. phys. [6] 17, 351, '89.)

Milligram Mols. per 10 cc. Sol. $\frac{1}{2}CuCl_2$.	Milligram Mols. per 10 cc. Sol. HCl.	Sp Gr. of Solutions.	Gms per 100 cc. Sol. $CuCl_2$.	Gms per 100 cc. Sol. HCl.	Gms. per 100 Gms. Sol. $CuCl_2$.	Gms. per 100 Gms. Sol. HCl.
91.75	0	1.49	61.70	0.0	41.41	0.0
86.8	4.5	1.475	58.37	1.64	39.58	1.11
83.2	7.8	1.458	55.95	2.84	38 37	1.95
79.35	10.5	1.435	53.37	3.83	37.19	2.67
68.4	20.25	1.389	46.01	7.38	33.11	5.31
50.0	37.5	1.319	33.62	13.67	25 50	10.37
22.8	70.25	1.231	15.33	25.61	12.46	20.80
23.5	102.5	1.288	15.81	37.36	12.27	29.00
26.7	128.0	1.323	17.96	46.66	13.57	35.26
			29.0	Sat. HCl		

COPPER CHLORIDE, AMMONIUM CHLORIDE MIXTURES IN AQUEOUS SOLUTION AT 30°.

(Meerburg — Z. anorg. Chem. 45, 3, '05.)

Grams per 100 Gms. Sat. Solution. $CuCl_2$.	Grams per 100 Gms. Sat. Solution. NH_4Cl.	Grams per 100 Gms. Solid Phase. $CuCl_2$.	Grams per 100 Gms. Solid Phase. NH_4Cl.	Solid Phase.
0	29.5	...	...	NH_4Cl
1.9	28.6	6.0	48.2	$NH_4Cl + CuCl_2.2NH_4Cl.2H_2O$
3.6	25.9	37.0	34.9	$CuCl_2.2NH_4Cl.2H_2O$
10.5	16.5	21.7	23.1	"
19.9	9.4	28.5	18.4	"
29.4	4.9	35.1	15.3	"
41.4	2.1	43 1	13.3	"
43.2	2.0	51.9	6.6	$CuCl_2.2NH_4Cl.2H_2O + CuCl_2.2H_2O$
43.9	0	...	.	$CuCl_2.2H_2O$

Additional determinations for the ammonia end of this system at 25° are given by Foote, 1912.

COPPER AMMONIUM CHLORIDE $CuCl_2.2NH_4Cl.2H_2O$.

SOLUBILITY IN WATER.

(Meerburg, 1905.)

t°.	Gms. $CuCl_2.2NH_4Cl$ per 100 Gms. Solution.	Solid Phase.	t°.	Gms. $CuCl_2.2NH_4Cl$ per 100 Gms. Solution.	Solid Phase.
−10.5	3.87	Ice	30	27.70	$CuCl_2.2NH_4Cl.2H_2O$
−10.8	20.12	"	40	30.47	"
−11	20.3	Ice+$CuCl_2.2NH_4Cl.2H_2O$	50	33.24	"
−10	20.46	$CuCl_2.2NH_4Cl.2H_2O$	60	36.13	"
0	22.02	"	70	39.35	"
12	24.26	"	80	43.36	"
20	25.95	"			

SOLUBILITY OF CUPROUS CHLORIDE IN AQUEOUS SOLUTIONS OF CUPRIC SULFATE AT ABOUT 20°.

(Bodländer and Storbeck, 1902.)

Millimols per Liter.					Grams per Liter.				
$CuSO_4$.	Total Cu.	Total Cl.	Cu (ic).	Cu (ous).	$CuSO_4$.	Total Cu.	Total Cl.	Cu (ic).	Cu (ous).
0	2.880	5.312	2.258	0 622	0	0.183	0.188	0.143	0.040
0 987	3.602	4.908	3.145	0 457	0.158	0.229	0.174	0.200	0.029
1.975	4 553	4.687	4.131	0 422	0.315	0.290	0.166	0.263	0 027
2.962	5.193	4.256	4.625	0.509	0.473	0.330	0.151	0.292	0.032
4.937	7.276	4.329	6.546	0.730	0.788	0.463	0.154	0.416	0.046

SOLUBILITY OF CUPROUS CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT ABOUT 20°.

(Bodländer and Storbeck, 1902.)

Millimols per Liter.					Grams per Liter.				
KCl.	Total Cu.	Total Cl.	Cu (ic).	Cu (ous).	KCl.	Total Cu.	Total Cl.	Cu (ic).	Cu (ous).
0	2.851	5.416	2.222	0.629	0	0.181	0.193	0.141	0.040
2.5	1.955	6.015	1.421	0 534	0.186	0.124	0.213	0.090	0.034
5	1.522	7.525	1 008	0 514	0.373	0.097	0.267	0.069	0.033
10	1.236	11.735	0.475	0.761	0.746	0.079	0 416	0.030	0.048
20	1.446	21.356	0 324	1.122	1.492	0.092	0.759	0.021	0.071
50	2.411	not det.	0.1088	2.302	3.730	0.153	not det.	0.007	0.146
100	4.702	"	0	4.702	7.460	0.299	"	0	0.299
200	9.485	"	0	9.485	14.920	0.603	"	0	0.603
1000	97	"	0	97	74.60	6.170	"	0	6.170
2000	384	"	0	384	149.2	24.42	"	0	24.420

The results in the 3d, 7th, 8th and last line of this table are at 16°.

SOLUBILITY OF COPPER CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE.

(Hunt, 1870.)

t°.	Gms. $CuCl_2$ per 100 cc Solution of: Sat. NaCl.	15% NaCl.	5% NaCl.
11	8.9	3.6	...
40	11.9	6	1.1
90	16.9	10.3	2.6

SOLUBILITY OF CUPROUS CHLORIDE IN AQUEOUS SOLUTIONS OF FERROUS CHLORIDE AT 21.5° AND VICE VERSA.

(Kremann and Noss, 1912.)

In order to ascertain the composition of the solid phase, the experiment was made by mixing together weighed amounts of H_2O, CuCl and $FeCl_2$ and agitating in a thermostat at constant temperature. A weighed portion of the clear saturated solution in each case was analyzed and the composition of the solid phase calculated by difference.

Gms. per 100 Gms. H_2O.		Solid Phase.	Gms. per 100 Gms H_2O.		Solid Phase.
$FeCl_2$.	CuCl.		$FeCl_2$.	CuCl.	
0	1.53	CuCl	43.75	12.42	CuCl
6.02	1.33	"	54	17.04	"
11.62	1.80	"	66.40	21.6	"
16.30	3.11	"	73.20	23.20	" $+FeCl_2.4H_2O$
26.30	7.12	"	71.90	21.65	$FeCl_2.4H_2O$
29.35	8.06	"	69.30	11.9	"
33.12	9.56	"	65.10	0	"

SOLUBILITY OF CUPROUS CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT 26.5° AND VICE VERSA.

(Kremann and Noss, 1912.)

(See remarks above.)

Gms. per 100 Gms. H_2O.		Solid Phase.	Gms. per 100 Gms. H_2O.		Solid Phase.
NaCl.	CuCl.		NaCl.	CuCl.	
0	1.55	CuCl	44.14	57.21	CuCl
10.8	3.15	"	55.10	44.10	NaCl
20.7	7.30	"	56.80	41.70	"
27	40.60	"	50.90	18.70	"
36.48	49.10	"			

SOLUBILITY OF CUPROUS CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 22° AND VICE VERSA.

(Brönsted, 1912.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
KCl.	CuCl.		KCl.	CuCl.		KCl.	CuCl.	
3.87	0.115	CuCl	21.64	13.32	CuCl	24.04	4.53	CuCl.2KCl
6.56	0.405	"	23.84	17.23	"	25.03	3.14	"
8.24	0.861	"	25.24	21.47	"	26.28	2.20	"
11.33	2.19	"	23.87	15.48	CuCl.2KCl	27.06	1.60	"
15.30	4.80	"	23.57	13.99	"	26.68	1.21	KCl
17.47	7.19	"	23.50	11.39	"	26.32	0.58	"
20.31	10.21	"	23.49	7.35	"	25.68	0	"

Solubility of Cupric Chloride in Aqueous Solutions of Mercuric Chloride at 35° and Vice Versa.

(Schreinemakers and Thonus, 1912.)

Gms. per 100 Gms. Sat Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$HgCl_2$.	$CuCl_2$.		$HgCl_2$.	$CuCl_2$.	
0	44.47	$CuCl_2.2H_2O$	52.54	18.46	$HgCl_2$
21.03	33.5	"	52.81	18.06	"
37.30	26.07	"	51.03	14.73	"
44.47	23.31	"	49.50	5.94	"
50.47	21.50	" $+HgCl_2$	23.87	2.64	"
52.44	19.40	$HgCl_2$	8.51	0	"

Solubility of Copper Chloride and Potassium Chloride Double Salts and Mixtures in Water.

(Meyerhoffer — Z. physik. Chem. 5, 102, '90.)

t°.	Cl per 1 Gram Solution.		Mols per 100 Mols. H_2O.		Solid Phase.
	Present as $CuCl_2$.	Present as KCl.	$CuCl_2$.	KCl.	
39.4	0.120	0.107	5.56	9.93	$CuCl_2.2KCl.2H_2O + KCl$
49.9	0.129	0.115	6.39	11.4	"
60.4	0.142	0.125	7.71	13.6	"
79.1	0.168	0.142	11.1	18.8	"
90.5	0.188	0.154	14.9	24.4	"
93.7	0.194	0.156	16.2	26.0	$CuCl_2.KCl + KCl$
98.8	0.197	0.162	17.5	28.7	"
0	0.214	0.021	9.84	1.94	$CuCl_2.2KCl.2H_2O + CuCl_2.2H_2O$
39.6	0.232	0.049	12.9	5.44	"
50.1	0.233	0.059	13.7	6.90	"
52.9	0.241	0.062	14.8	7.63	"
60.2	0.246	0.066	15.8	8.49	$CuCl_2.KCl + CuCl_2.2H_2O$
72.6	0.255	0.063	16.8	8.35	"
64.2	...	...	14.9	11.6	$CuCl_2.2KCl.2H_2O + CuCl_2.KCl$
72.5	...	...	14.8	15.0	$CuCl_2.KCl$

Solubility of Cupric Chloride in Aqueous Solutions of Sodium Chloride at 30° and Vice Versa.

(Schreinemakers and de Baat, 1908–09.)

Gms. per 100 Gms Sat Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
NaCl.	$CuCl_2$.		NaCl.	$CuCl_2$.	
0	43.95	$CuCl_2.2H_2O$	12.25	32.40	NaCl
3.10	41.14	"	13.54	28.64	"
4.28	41.06	"	15.40	23.72	"
6.41	39.40	"	18.44	16.98	"
10.25	36.86	" +NaCl	20.61	11.03	"
12.02	32.38	NaCl	26.47	0	"

SOLUBILITY OF CUPRIC CHLORIDE IN AQUEOUS ALCOHOL AT 11.5°.

(Bödtker, 1897.)

10 gms. of $CuCl_2 2H_2O$ and the indicated amounts of $CuCl_2$ were added to 20 cc. portions of alcohol. The solutions shaken two hours and 5 cc. portions withdrawn.

Vol. % Alcohol.	Gms. $CuCl_2$ Added.	Gms. per 5 cc. Solution.		Vol. % Alcohol.	Gms. $CuCl_2$ Added.	Gms. per 5 cc. Solution.	
		H_2O.	$CuCl_2$.			H_2O.	$CuCl_2$.
89.3	0	0.794	1.137	99.3	0.223	0.330	1.295
92.3	0	0.648	1.090	99.3	0.887	0.247	1.639
96.3	0	0.478	1.116	99.3	1.540	0.191	2.086
99.3	0	0.369	1.208	99.3	1.957	0.164	2.400

SOLUBILITY OF CUPRIC CHLORIDE IN SEVERAL SOLVENTS.

(Etard — Ann. chim. phys. [7] 2, 564, '04; de Bruyn — Z. physik. Chem. 10, 783, '92; de Coninck — Compt. rend. 131, 59, '00; St. von Laszczynski — Ber. 27, 2285, '94.)

Solvent.	Grams $CuCl_2$ per 100 Grams Sat. Solution at:				
	0°.	15°.	20°.	40°.	80°.
Methyl Alcohol	36	40.5 (de B.)	36.5	37.0	...
Ethyl Alcohol	32	35.0 (de B.)	35.7	39.0	...
Propyl Alcohol	29	...	30.5	30.5	...
Iso Propyl Alcohol	...	...	...	16.0	30.0
n Butyl Alcohol	15	...	15.3	16.0	16.5
Allyl Alcohol	23	...	23.0	...	...
Ethyl Formate	10	...	9.0	8.0	...
Ethyl Acetate	...	...	3.0	2.5	1.3 (72°)
Acetone (abs.)	8.86*	8.92†	2.88 (18°)	...	1.40 (56°)
Acetone (80%)	...	...	18.9‡	...	...
Ether	...	0.043 (11°)	0.11	...	...

* ($CuCl_2$.2 Aq.) † ($CuCl_2$.2 Aq.) ‡ (23° $CuCl_2$.2 Aq.)

For the solubility of cupric chloride in mixtures of a number of organic solvents, see de Coninck.

Solvent.	t°.	Gms. $CuCl_2$ per 100 Gms. Sat. Sol.	Sp. Gr. Sat. Sol.	Authority.
Acetonitrile	18	1.57	...	(Naumann and Schier, 1914.)
Ethyl Acetate	18	0.4	0.9055	(Naumann, 1904)
Methyl Acetate	18	0.55	0.939	(Naumann, 1909.)
Anhydrous Hydrazine	ord. temp.	5 (decomp)	...	(Welsh and Broderson, 1915.)

SOLUBILITY OF CUPROUS CHLORIDE IN ACETONITRILE. (Naumann and Schier, 1914.)

100 gms. acetonitrile of boiling point 81.6° dissolve 13.33 gms. CuCl at 18°.

SOLUBILITY OF CUPRIC CHLORIDE IN PYRIDINE.

(Mathews and Spero, 1917.)

t°.	Gms. $CuCl_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°	Gms. $CuCl_2$ per 100 Gms. Sat. Sol.	Solid Phase.
−17.3	0.140	$CuCl_2.6C_5H_5N$	45	0.422	$CuCl_2.2C_5H_5N$
−12.1	0.195	"	53	0.493	"
−10	0.295	" (unstable)	60	0.565	" (unstable)
− 8.9 tr. pt.	0.270	" +$CuCl_2.2C_5H_5N$	62	0.616	" "
+ 2	0.275	$CuCl_2.2C_5H_5N$	58 tr. pt.	...	" +$2CuCl_2.3C_5H_5N$
10	0.293	"	63	0.543	$2CuCl_2.3C_5H_5N$
25	0.348	"	75	0.631	"
35	0.382	"	95	0.917	"

Distribution of Cupric Chloride between aq. HCl and Ether

When 1 gm. of copper as chloride is dissolved in 100 cc. of 10% HCl and shaken with 100 cc. of ether, 0.05% of the metal enters the ethereal layer. (Mylius, 1911.)

COPPER Ammonium **CHLORIDE** $CuCl_2.NH_4Cl$.

Solubility in Absolute Alcohol at 25°. (Foote and Walden, 1911.)

Gms. per 100 Gms. Sat. Sol. $CuCl_2$.	NH_4Cl.	Solid Phase.
4.7	not det.	$NH_4Cl+CuCl_2.NH_4Cl$
6.45	"	$CuCl_2.NH_4Cl$
12.90	"	"
34.7	"	" $+CuCl_2.C_2H_5OH$

COPPER Potassium **CHLORIDE** $CuCl_2.KCl$.

Solubility in Absolute Alcohol and in Acetone at 25°. (Foote and Walden, 1911)

In Absolute Alcohol.			In Acetone.		
Gms. per 100 Gms. Sat. Sol. $CuCl_2$.	KCl.	Solid Phase.	Gms. per 100 Gms Sat. Sol. $CuCl_2$.	KCl	Solid Phase.
1.40	0.28	$KCl+CuCl_2.KCl$	0.34	0.38	$KCl+CuCl_2.KCl$
2.15	not. det.	$CuCl_2.KCl$	0.48	not det.	$CuCl_2.KCl$
5.25	"	"	1.50	"	"
30.16	"	"	2.06	"	"
34.45	0.21	" $+CuCl_2.C_2H_5OH$	2.40	0.27	" $+CuCl_2.C_3H_6O$
33.97	0	$CuCl_2.C_2H_5OH$			

Freezing-point data (solubility, see footnote, p. 1) are given for the following mixtures of cuprous chloride and other chlorides.

$CuCl + CuCl_2$ (Sandonnini, 1912 (*a*)).
" $+ FeCl_3$ (Hermann, 1911.)
" $+ PbCl_2$ "
" $+ LiCl$ (Sandonnini, 1911, 1914; Korreng, 1914.)
" $+ RbCl$ (Sandonnini, 1914; Sandonnini and Aureggi, 1912.)
" $+ AgCl$ (Sandonnini, 1911, 1914; Poma and Gabbi, 1911, 1912)
" $+ KCl$ (Sandonnini, 1911, 1914; Korreng, 1914; Sackur, 1913; Poma and Gabbi, 1911, 1912.)
" $+ NaCl$ (Sandonnini, 1911, 1914; Korreng, 1914; Sackur, 1913; de Cesari, 1911.)
" $+ TlCl$ (Sandonnini, 1911, 1914)
" $+ SnCl_2$ (Hermann, 1911.)
" $+ ZnCl_2$ " "

Freezing-point lowering data for mixtures of $CuCl + Cu_2O$ and $CuCl + Cu_2S$ are given by Truthe, 1912.

COPPER Potassium **CITRATE** $CuK_4[(COOCH_2)_2C(OH)COO]_2$.

100 cc. sat. solution in H_2O contain 43.3 gms. of the salt at 10°. (Pickering, 1915.)

COPPER CYANIDE (ous) $Cu_2(CN)_2$.

Freezing-point data for $Cu_2(CN)_2 + KCN$ and $Cu_2(CN)_2 + NaCN$ are given by Truthe (1912).

COPPER HYDROXIDE (ic) $Cu(OH)_2$.

Solubility in Aqueous Solutions of Ammonia at 18°. (Dawson, 1909.)

Mols. NH_3 per Liter.	Gm. Atoms Cu per Liter.	Mols. NH_3 per Liter.	Gm. Atoms Cu per Liter.
0.2	0.00054	3	0.0548
0.5	0.0033	4	0.0784
1	0.0109	5	0.1041
1.5	0.0204	6	0.1254
2	0.0314	8	0.1599
2.5	0.0442	9.96	0.1787

Three series of results at 25°, somewhat higher than the above, are given by Bonsdorff, 1904.

Data showing the effect of increasing amounts of $(NH_4)_2SO_4$, $Ba(OH)_2$, NaOH and of Na_2SO_4 upon the solubility of cupric hydroxide in aqueous ammonia solution at 18°, are given by Dawson, 1909 a.

COPPER IODATE (ic) $Cu(IO_3)_2.H_2O$.

One liter sat. aqueous solution contains 1.36 gms. $Cu(IO_3)_2$ at 25°, determined by measurement of single potential differences against a 0.1 *n* calomel electrode. (Spencer, 1913.)

COPPER IODIDE (ic) CuI_2.

One liter sat. aqueous solution contains 11.07 gms. CuI_2 at 20°. (Fedotieff, 1911–12.)

COPPER IODIDE (ous) Cu_2I_2.

SOLUBILITY OF CUPROUS IODIDE IN AQUEOUS SOLUTIONS OF AMMONIUM BROMIDE AND OF POTASSIUM BROMIDE.

(Kohn, 1909; Kohn, and Klein, 1912.)

Results for Aq. NH_4Br at 20°.

Normality NH_4Br Sol.	Gms. Cu_2I_2 per 1000 cc. Sat. Sol.
2	1.9068
3	3.6540
4	6.0588

Results for Aq. KBr Solutions.

t°.	Normality of KBr Sol.	Gms. Cu_2I_2 per 1000 cc. Sat. Sol.	t°.	Normality of KBr Sol.	Gms. Cu_2I_2 per 1000 Gms. Sat. Sol.
19.5	2	1.467	23	3	3.595
24	2	1.558	22	4	7.126
19.5	3	3.409	22	4	6.977

SOLUBILITY OF CUPROUS IODIDE IN AQUEOUS SOLUTIONS OF IODINE AT 20° AND VICE VERSA. (Fedotieff, 1910–11)

Gms. per Liter. Cu.	I.	Solid Phase.	Gms. per Liter. Cu	I	Solid Phase.		Gms per Liter Cu.	I	Solid Phase.
0.285	0.5848	CuI	0.964	5.0854	CuI		0.748	4.7112	I
0.482	1.3053	"	1.032	5.6854	"		0.606	3.8562	"
0.583	1.9218	"	1.090	6.2816	"		0.448	2.9493	"
0.678	2.5573	"	1.112	6.5301	"		0.300	2.0689	"
0.756	3.2042	"	1.232	7.6529	" +I		0.159	1.2304	"
0.844	3.9539	"	1.040	6.4440	I	at 0°=	0.925	5.4609	CuI+I
0.898	4.4359	"	0.898	5.5941	"	at 40°=	1.658	11.3658	"

Constant agitation and temperature. Iodine determined by thiosulfate titration; copper, electrolytically.

Additional data for the solubility of cuprous iodide in aqueous solutions of iodine in presence of acids and salts at 25°, are given by Bray and MacKay (1910). These authors state that cuprous iodide is difficultly soluble in water, but in the presence of iodine a considerable amount dissolves, owing to the formation of cupric iodide and tri-iodide.

100 gms. acetonitrile dissolve 3.52 gms. Cu_2I_2 at 18°. (Naumann and Schier, 1914)

Freezing-point lowering data for mixtures of CuI + AgI are given by Quercigh, '14.

COPPER NITRATE (ic) $Cu(NO_3)_2$.

SOLUBILITY IN WATER. (Funk, 1900)

t°.	Gms. $Cu(NO_3)_2$ per 100 Gms. Solution.	Mols $Cu(NO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Cu(NO_3)_2$ per 100 Gms. Solution.	Mols. $Cu(NO_3)_2$ per 100 Mols H_2O.	Solid Phase.
−23	36.08	5.42	$Cu(NO_3)_2.9H_2O$	20	55.58	12	$Cu(NO_3)_2.6H_2O$
−20	40.92	6.65	"	26.4	63.39	16.7	"
−21	39.52	6.27	$Cu(NO_3)_2.6H_2O$	25	60.01	14.4	$Cu(NO_3)_2.3H_2O$
0	45	7.87	"	40	61.51	15.2	"
+10	48.79	9.15	"	60	64.17	17.2	"
18	53.86	11.20	"	80	67.51	20	"
				114.5	77.59	33.3	"

Density of solution saturated at 18° = 1.681.

100 gms. H_2O dissolve 127.4 gms. $Cu(NO_3)_2$ at 20°, d_{20} sat. sol. = 1.688. (Fedotieff, 1911–12.)

Data for the solubility of copper nitrate in aq. ammonia solutions are given by Stasevich, 1913.

Data for the solubility of copper nitrate in aq. solutions of copper sulfate and of sodium nitrate at 20° are given by Massink, 1916 and 1917.

100 cc. anhydrous hydrazine dissolve 1 gm. copper nitrate, with decomposition, at room temp. (Welsh and Broderson, 1915.)

COPPER OXALATE (ic) $CuC_2O_4.\frac{1}{2}H_2O$.

One liter H_2O dissolves 0.02364 gm. CuC_2O_4 at 25°, determined by the conductivity method. (Schäfer, 1905.)

COPPER OXIDE (ic) CuO.

SOLUBILITY IN AQUEOUS SOLUTIONS AT 25°.
(Jaeger, 1901.)

In Aq. Hydrofluoric Acid.		In Aq. HF + KF.		In Aq. HNO_3 and CH_3COOH.	
Normality of HF.	Gm. Atoms Cu per Liter.	Normality of HF.	Gm. Atoms Cu per Liter.	Solvent.	Gm. Atoms Cu per Liter.
0.12	0.0307	0.12	0.0356	1 *n* CH_3COOH	0.1677
0.28	0.1164	0.28	0.06437	1 *n* HNO_3	0.4802
0.57	0.2494	0.57	0.1442		
1.08	0.388	1.11	0.2451		
2.28	0:463	2.17	0.2517		

Cu determined electrolytically.

COPPER OXIDE (ous) Cu_2O.

SOLUBILITY IN AQUEOUS AMMONIUM SOLUTIONS AT 25°.
(Donnan and Thomas, 1911)

The cuprous oxide was prepared by adding KOH solution to a mixture of equal weights of $CuSO_4.5H_2O$ and sucrose dissolved in water, until nearly all the precipitate had redissolved. The solution was kept at 70° until the cuprous oxide had separated. Two batches were prepared. The first, No. I, obtained from the more dilute solution, was bulky and dark red in color, Cu = 88.62%. The second, No. II, was bright red, Cu = 88.59%. The solubility determinations were made with extreme care. A special apparatus was used. By means of this, the constituents of the mixtures were introduced into the bottles in an atmosphere of hydrogen and every precaution taken to prevent oxidation. The bottles were sealed and rotated for 2–4 weeks at constant temperature. In case the slightest tinge of blue developed in a bottle (indicating oxidation), it was rejected.

Results for Preparation No. I.				Results for Preparation No. II.			
Gms per 1000 Gms Sol.		Mols. per 1000 Gms. Sol.		Gms. per 1000 Gms. Sol.		Mols. per 1000 Gms. Sol.	
Cu.	NH_3	Cu.	NH_3.	Cu.	NH_3.	Cu.	NH_3.
0.3593	3.91	0.00566	0.23	0.4229	7.82	0.00665	0.46
0.6869	13.77	0.01080	0.81	0.6678	8.16	0.01050	0.48
1.0144	27.03	0.01597	1.59	0.9890	22.61	0.01555	1.33
1.0462	32.64	0.01645	1.92	1.0494	28.39	0.01650	1.67
1.3229	68.68	0.02081	4.04	1.3528	54.15	0.02127	3.19
1.4882	74.12	0.02340	4.36	1.5048	72.08	0.02366	4.24
1.6313	98.52	0.02565	5.56	1.5963	78.20	0.02510	4.60
1.6981	122.40	0.02670	7.20	1.6555	102.05	0.02603	6

COPPER SULFATE $CuSO_4.5H_2O$.

SOLUBILITY IN WATER.
(Etard, 1894; Patrick and Aubert, 1874; at 15°, Cohen, 1903; at 25°, Trevor, 1891.)

t°.	Gms. $CuSO_4$ per 100 Gms. Solution.	Gms. $CuSO_4$ per 100 Gms. Water.	t°.	Gms $CuSO_4$ per 100 Gms. Solution.	Gms $CuSO_4$ per 100 Gms. Water.
0	12.5	14.3	60	28.5	49
10	14.8	17.4	80	35.5	55
20	17.2	20.7	100	43	75.4
25	18.5	22.7	120	44	78.6
30	20	25	140	44.5	80.2
40	22.5	28.5	160	44	78.6
50	25	33.3	180	43	75.4

Sp. gr. of sat. solution of $CuSO_4.5H_2O$ in H_2O at 16° = 1.193. (Greenish, 1902.)
100 gms. sat. solution in H_2O contain 20.32 gms. $CuSO_4$ at 30°. (Schreinemakers, 1910.)

Solubility of Copper Sulfate in Aqueous Solutions of Ammonium Sulfate at 0°.

(Engel, 1886.)

Milligram Equiv. per 10 cc. Solution.		Sp. Gr. of Solutions.	Grams per 100 cc. Solution.	
$(NH_4)_2SO_4$.	CuSO.		$(NH_4)_2SO_4$.	$CuSO_4$.
0	18.52	1.144	0	14.79
5.45	20.15	1.190	3.61	16.09
7	10.5	1.108	4.63	8.38
7.4	9.1	1.099	4.90	7.26
8.45	6.425	1.0815	5.59	5.13
11.35	3.7	1.071	7.51	2.95
18.6	1.178	1.082	12.31	0.94
31.2	1	1.116	20.65	0.80

Solubility of Mixtures of Copper Ammonium Sulfate and Nickel Ammonium Sulfate in Water at 13°-14°:

(Fock, 1897.)

$CuSO_4.(NH_4)_2SO_4.6H_2O + NiSO_4.(NH_4)_2SO_4.6H_2O$.

Mol. % in Solution.		Mols. per 100 Mols H_2O		Mol. % in Solid Phase.	
Cu Salt.	Ni Salt.	Cu Salt.	Ni Salt.	Cu Salt.	Ni Salt.
0	100	0	0.521	0	100
33.34	66.66	0.1476	0.295	10.29	89.71
56.05	43.95	0.2664	0.2089	30.59	69.41
73.89	26.20	0.4165	0.1449	52.23	47.77
79.92	20.08	0.4785	0.1202	78.80	21.20
100	0	1.0350	0	100	0

Solubility of Mixtures of Copper Ammonium Sulfate and Zinc Ammonium Sulfate in Water at 13°-14°.

(Fock, 1897)

$CuSO_4.(NH_4)_2SO_4.6H_2O + ZnSO_4.(NH_4)_2SO_4.6H_2O$.

Mol. % in Solution.		Mols per 100 Mols H_2O.		Mol % in Solid Phase.	
Cu. Salt	Zn Salt.	Cu Salt.	Zn Salt.	Cu Salt.	Zn Salt.
4.97	95.03	0.0422	0.8069	2.39	97.61
10.65	89.35	0.0666	0.5638	4.52	95.48
19.24	80.76	0.1218	0.5115	90.3	90.97
30.19	69.81	0.2130	0.4924	14.67	85.33
44.44	55.56	0.3216	0.4022	22.62	77.38
100	0	1.035	0	100	0

Solubility of Copper Sulfate in Aqueous Solutions of Magnesium Sulfate at 0°.

(Diacon, 1866.)

Gms. per 100 Gms. H_2O.		Solid Phase.	Gms. per 100 Gms. H_2O.		Solid Phase.
$CuSO_4$.	$MgSO_4$.		$CuSO_4$.	$MgSO_4$.	
0	26.37	$MgSO_4.6H_2O$	12.03	15.67	$CuSO_4.5H_2O$
2.64	25.91	"	13.61	8.64	"
4.75	25.30	"	14.99	0	"
9.01	23.30	$MgSO_4.6H_2O+CuSO_4.5H_2O$			

SOLUBILITY OF COPPER SULFATE IN AQUEOUS SOLUTIONS OF COPPER CHLORIDE AT 30°.

(Schreinemakers, 1910.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$CuCl_2$.	$CuSO_4$.		$CuCl_2$.	$CuSO_4$.	
0	20.32	$CuSO_4.5H_2O$	39.48	3.21	$CuSO_4.5H_2O$
6.58	13.62	"	42.62	2.90	" $+CuCl_2.2H_2O$
15.68	8.93	"	43.25	1.14	$CuCl_2.2H_2O$
25.67	4.77	"	43.95	0	"

DATA FOR EQUILIBRIUM IN COMPLEX SYSTEMS CONTAINING COPPER SULFATE.

System.	Authority.
$CuSO_4 + CuCl_2 + (NH_4)_2SO_4 + NH_4Cl + H_2O$	(Schreinemakers, 1910.)
" + " $+ K_2SO_4 + KCl + H_2O$	(Schreinemakers and de Baat, 1914a.)
" + " $+ Na_2SO_4 + NaCl + H_2O$	(Schreinemakers, 1911.)
" $+ Li_2SO_4 + (NH_4)_2SO_4 + H_2O$	(Schreinemakers, 1909.)

SOLUBILITY OF COPPER SULFATE IN AQUEOUS SOLUTIONS OF LITHIUM SULFATE AT 30°.

(Schreinemakers, 1908, 1909.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms per 100 Gms. Sat. Sol.		Solid Phase.
Li_2SO_4.	$CuSO_4$.		Li_2SO_4	$CuSO_4$	
0	20.32	$CuSO_4.5H_2O$	17.92	11.04	$CuSO_4.5H_2O$
3.54	17.59	"	20.55	10.05	" $+Li_2SO_4.H_2O$
6.08	16.10	"	22.23	6.41	$Li_2SO_4.H_2O$
11.94	13.55	"	23.59	3.39	"
15.72	12.14	"	25.24	0	"

SOLUBILITY OF COPPER SULFATE IN AQUEOUS SOLUTIONS OF LITHIUM AND OTHER CHLORIDES AT 25°.

(Herz, 1910)

In Lithium Chloride. Gms. per 100 cc. Sat. Sol.		In Potassium Chloride. Gms. per 100 cc. Sat. Sol		In Rubidium Chloride. Gms per 100 cc. Sat. Sol		In Sodium Chloride. Gms. per 100 cc. Sat. Sol.	
LiCl.	$CuSO_4$.	KCl.	$CuSO_4$.	RbCl.	$CuSO_4$.	NaCl.	$CuSO_4$.
3.10	20.06	4.19	23.89	0	22.34	2.10	22.41
5.93	18.78	8.75	24.92	13.22	25.02	7.72	22.76
12	17.03	17.50	29.03			14.79	24.05

SOLUBILITY OF COPPER POTASSIUM SULFATE $CuK_2(SO_4)_2.6H_2O$ IN WATER AT 25°.

100 gms. H_2O dissolve 11.14 gms. $CuK_2(SO_4)_2$. (Trevor, 1891.)

Additional data for the system Copper sulfate + Potassium sulfate + H_2O are given by Meerburg, 1909.

Data for the solubility in water of mix-crystals of copper sulfate and manganese sulfate at 0° and 17°, and of copper sulfate and zinc sulfate at 12°, 18°, 25°, 35°, 40° and 45°, are given by Hollemann, 1905–06.

Copper Sulfate, Manganese Sulfate, Mixed Crystals at 25°.

(Stortenbecker, 1900.)

Gms. per 100 Gms. H_2O. $CuSO_4$.	$MnSO_4$.	Mols. per 100 Mols. H_2O. Cu.	Mn.	Mol. % Cu in Solution.	Mol. % Cu in Crystals.
Triclinic Crystals with $5H_2O$.					
20.2	0	2.282	0	100	100
				90.5	99.3
19.76	3.69	2.23	0.44	83.5	...
				74.1	97.3
				57.7	95.1
				31.0	81.3
13.65	31.52	1.54	3.76	29 0	...
				26.1	70.4
11.61	39.41	1.31	4.70	21.8	...
				21.2	42.6
				20.0	34.4
9.39	46.77	1.06	5.59	15.9	22.9
				13.45*	15.2*
6.47	53.39	0.73	6.37	10.27	10.5
				5 0	4.9
3.01	58.93	0.34	7.03	4.6	...
				2.31	2.15
0.0	61.83	0.0	7.375	0.0	100.0
Monoclinic Crystals with $7H_2O$.					
				20.0	28.2
9.39	46.77	1.06	5.58	15.9	23.5
				13.45	20.8
6.47	53.39	0.73	6.37	10.27	16.0
				4.6*	5.8*
0.0	67.07±	0.0	8±*	0.0	100

* Indicates points of labil equilibrium.

Copper Sulfate, Zinc Sulfate, Mixed Crystals in Water at 18°.

(Stortenbecker, 1897.)

Mols. per 100 Mols. H_2O. Cu.	Zn.	Mol. % Cu in Solution.	Mol % Cu in Crystals.	
2.28	0	100	100	Triclinic Crystals with $5H_2O$.
1.83	2.08	46.8	94.9	
1.41	3.60	28.1		
1.19	5.01	19.2	77.9	
1.86	3.36	36.2	40.4	Monoclinic Crystals with $7H_2O$.
1.22	4.45	21.5	29.5–31.9	
1.01	4.72	17.6	24.1–28.	
0.82	5.03	14.0	19.0–22.	
0.51	5.59	8.36	12.4–14.9	
0.30	5.56	4.87	7.02	
0.0	6.42	0.0	0	
1.19	5.01	19.2	5.01	Rhombic Crystals with $7H_2O$.
0.51	5.59	8.36	1.97	
0.267	5.77	4.42	1.15	
0.0	5.94	0.0	0.00	

SOLUBILITY OF COPPER SULFATE, SODIUM SULFATE MIXTURES IN WATER.
(Koppel, 1901–02; Massol and Maldes, 1901.)

t°.	Gms. per 100 Gms. Solution. CuSO₄.	Gms. per 100 Gms. Solution. Na_2SO_4.	Mols. per 100 Mols. H_2O. $CuSO_4$.	Mols. per 100 Mols. H_2O. Na_2SO_4.	Solid Phase.
0	13.40	6.23	1.88	0.98	$CuSO_4.5H_2O+Na_2SO_4.10H_2O$
10	14.90	9.46	2.23	1.56	"
15	15.18	11.64	2.34	2.02	"
17.7	14.34	13.34	2.24	2.34	$CuSO_4.Na_2SO_4.2H_2O$
23	14.36	12.76	2.23	2.21	"
40.15	13.73	12.26	2.10	2.10	"
17.7	14.99	13.48	2.37	2.39	$CuSO_4.Na_2SO_4.2H_2O+CuSO_4.5H_2O$
23	16.41	11.35	2.57	1.99	"
40.15	20.56	8	3.25	1.47	"
18	13.53	13.84	2.10	2.41	$CuSO_4.Na_2SO_4.2H_2O+Na_2SO_4.10H_2O$
20	11.34	15.70	1.76	2.73	"
25	6.28	21.20	0.98	3.70	"
30	2.607	28.38	0.43	5.21	"
33.9	1.475	32.30	0.25	6.18	"
37.2	1.494	31.96	0.25	6.08	"
30	5.38	22.17			$CuSO_4.Na_2SO_4.2H_2O$+increasing amts. of $Na_2SO_4.10H_2O$
30.1	3.69	25.37	...	...	
30	1.57	32.09			

Data for the system copper sulfate, sodium sulfate, water, at 20° and 35° are given by Massink, 1916, 1917.

SOLUBILITY OF COPPER SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 0°. (Engel, 1887.)

Milligram Equiv. per 10 Gms. H_2O. H_2SO_4.	Milligram Equiv. per 10 Gms. H_2O. $CuSO_4$.	Sp. Gr. of Solutions.	Grams per 100 Grams H_2O. H_2SO_4.	Grams per 100 Grams H_2O. $CuSO_4$.
0	18.6	1.144	0	14.85
4.14	17.9	1.143	2.03	14.29
14.6	19.6	1.158	7.16	15.65
31	12.4	1.170	15.20	9.90
54.2	8.06	1.195	26.57	6.43
56.25	7.75	1.211	27.57	6.19
71.8	5	1.224	35.2	3.99

SOLUBILITY OF COPPER SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°. (Bell and Taber, 1908; Foote, 1915)

Gms. per 100 Gms. Sat. Sol. H_2SO_4.	Gms. per 100 Gms. Sat. Sol. $CuSO_4$.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. H_2SO_4.	Gms. per 100 Gms. Sat. Sol. $CuSO_4$.	Solid Phase.
0	18.47	$CuSO_4.5H_2O$	55.72	2.13	$CuSO_4.3H_2O+CuSO_4.H_2O$
11.14	12.62	"	61.79	0.95	$CuSO_4.H_2O$
25.53	5.92	"	77.93	0.17	"
36.77	3.25	"	83.29	0.15	"
42.15	2.63	"	85.46	0.19	"
47.66	2.59	"	85.76	0.43	" $+CuSO_4$
49	2.83	" $+CuSO_4.3H_2O$	86.04	0.40	$CuSO_4$
50.23	2.70	$CuSO_4.3H_2O$	92.70	0.19	"
54.78	2.19	"			

SOLUBILITY OF COPPER SULFATE IN METHYL AND ETHYL ALCOHOL, ETC.
(de Bruyn, 1892; de Coninck, 1905)

Solvent.	t°.	Gms per 100 Gms. Solv. $CuSO_4$.	Gms per 100 Gms. Solv. $CuSO_4.5H_2O$.
Methyl Alcohol Abs.	18	1.05	15.6
" " 93.5%	18	...	0.93
" " 50%	18	...	0.40
" " Abs.	3	...	13.4
Ethyl Alcohol Abs.	3	...	1.1
Glycol	14.6	...	7.6*
Glycerol	15.5	...	30
Glycerol	15–16	...	36.3 (Ossendowski, 1907)
95% Formic Acid	18.5	...	0.05 (Aschan, 1913)
Anhy. Hydrazine	ord. t. 2		...† (Welsh and Broderson, 1915)

* Per 100 gms solution. † decomp.

SOLUBILITY IN AQUEOUS ALCOHOL AT 15°.
(Schiff, 1861.)

Wt. % Alcohol.	Gms $CuSO_4.5H_2O$ per 100 g Solvent.
10	15.3
20	3.2
40	0.25

Data for the solubility of copper sulfate in methyl alcohol are given by Carrara and Minozzi, 1897.

COPPER SULFIDE (ic) CuS.

One liter of water dissolves 0.00033 gm. CuS at 18°, determined by the conductivity method. (Weigel, 1906; see also Bruner and Zawadski, 1909.)

100 cc. sat aq. sodium sulfide solution (of d = 1.225) dissolve 0.0032 gm. CuS. (Holland, 1897.)

SOLUBILITY OF COPPER SULFIDE IN AQUEOUS SUGAR SOLUTIONS.
(Stolle, 1900)

% Sugar in Solvent.	Gms. CuS per Liter of Aq Sugar Solution at: 17.5°.	45°.	75°.
10	0.5672	0.3659	1.1345
30	0.8632	0.7220	1.2033
50	0.9076	1.0589	1.2809

COPPER SULFIDE (ous) Cu_2S.

Freezing-point lowering data (solubility, see footnote, p. 1) for mixtures of $Cu_2S + Ag_2S$, $Cu_2S + PbS$ and $Cu_2S + ZnS$ are given by Friedrich, 1907–08. Results for $Cu_2S + Sb_2S_3$ are given by Chikashigi and Yamanchi, 1916. Data for $Cu_2S + FeS$ are given by Shad and Bornemann, 1916.

COPPER SULFONATES.

100 gms. H_2O dissolve 0.25 gm. copper 2-phenanthrene monosulfonate at 20°.
" " " 0.09 " " 3- " " "
" " " 0.26 " " 10- " " "
(Sandquist, 1912.)

COPPER TARTRATE $CuC_4O_6H_4.3H_2O$.

SOLUBILITY IN WATER.
(Cantoni and Zachoder, 1905.)

t°.	Gms. $CuC_4O_6H_4.3H_2O$ per 100 cc. Solution.	t°.	Gms. $CuC_4O_6H_4.3H_2O$ per 100 cc. Solution.	t°.	Gms. $CuC_4O_6H_4.3H_2O$ per 100 cc. Solution.
15	0.0197	40	0.1420	65	0.1767
20	0.0420	45	0.1708	70	0.1640
25	0.0690	50	0.1920	75	0.1566
30	0.0890	55	0.2124	80	0.1440
35	0.1205	60	0.1970	85	0.1370

COPPER THIOCYANATE (ic) $Cu(SCN)_2$.

SOLUBILITY IN AQUEOUS AMMONIA SOLUTIONS AT 25° AND AT 40°.

(Horn, 1907.)

d_{25} Sat. Sol.	Results at 25°. Gms. per 100 Gms. Sat. Sol. NH_3.	$Cu(SCN)_2$.	Solid Phase.	Results at 40°. Gms. per 100 Gms. Sat. Sol. NH_3.	$Cu(SCN)_2$.	Solid Phase.
1.0082	0.79	2.45	$Cu(SCN)_2.2NH_3$	0.94	2.81	$Cu(SCN)_2.2NH_3$
1.0166	1.98	4.08	"	1.77	4.18	"
1.0213	2.50	5.11	"	2.57	6.55	"
1.0171	4.26	5.96	$Cu(SCN)_2.4NH_3$	3.52	8.76	"
1.0151	5.35	6.22	"	4.35	11.78	$Cu(SCN)_2.4NH_3$
1.0134	6.39	6.59	"	5.50	12.07	"
1.0070	9.93	7.98	"	7.58	12.99	"
0.9987	16.55	11.24	"	13.98	16.58	"
0.9985	21.47	15.22	"	18.02	19.76	"

COUMARIN $C_9H_6O_2$.

100 gms. water	dissolve 0.01 gm.	coumarin at 20°-25°.	(Dehn, 1917.)
" pyridine	" 87.7 gms.	" " "	"
" 50% aq. pyridine	" 60.1 "	" " "	"
" chloroform	" 49.4 "	" " 25°.	(Osaka, 1903-08.)

Freezing-point lowering data for mixtures of coumarin and sulfuric acid are given by Kendall and Carpenter, 1914.

CRESOLS $C_6H_4(OH)CH_3$ *o*, *m* and *p*.

SOLUBILITY OF EACH SEPARATELY IN WATER.

(At 20°, Vaubel, 1895; Sidgwick, Spurrell and Davies, 1915)

Determinations by synthetic method; melting-point of o = 29.9°, of m = 4°, of p = 33.8°. Triple point for o = 87 and 2.5 gms. per 100 gms. sat. sol. at 8°; triple point for p = 86 and 2 gms. per 100 gms. sat. sol. at 8.7°.

t°.	Gms. per 100 Gms. Sat Solution. *o* Cresol.	*m* Cresol.	*p* Cresol.	t°.	Gms. per 100 Gms. Sat Solution. *o* Cresol.	*m* Cresol.	*p* Cresol.
20	2.45	2.18	1.94	120	6.22	7	6.58
40	3.08	2.51	2.26	130	6.70	8.86	9
50	3.22	2.72	2.43	140	7.67	12.3	15.9
60	3.40	2.98	2.69	143.5 crit. t.	...	...	∞
70	3.74	3.35	3.03	147 crit. t.	...	∞	
80	4.22	3.80	3.52	150	11.1		
90	4.80	4.43	4.16	160	23.7		
100	5.30	5.47	5.10	162.8 crit. t.	∞		
110	5.80	5.96	5.50				

One liter aqueous 1 normal solution of the sodium salt of *o* cresol dissolves 7.57 gms. *o* cresol at 25°, 8.32 gms. at 40°, 9.84 gms. at 60° and 13.62 gms. at 80° (Sidgwick, 1910.)

MISCIBILITY OF AQUEOUS ALKALINE SOLUTIONS OF *m* CRESOL WITH SEVERAL ORGANIC COMPOUNDS INSOLUBLE IN WATER.

(Sheuble, 1907.)

To 5 cc. portions of aq. KOH solution (250 gms. per liter) were added the given amounts of the aq. insoluble compound from a buret, and then the *m* cresol dropwise, until solution occurred. Temp. not stated.

Composition of Homogeneous Solution. cc. Aq. KOH.	Aq. Insol. Cmpd.	*m* Cresol.
5	2 cc. (1.64 gms.) Octyl Alcohol*	1.1 gms.
5	5 " (4.1 ") " "	1.8 "
5	2 " (1.74 ") Toluene	4.4 "
5	3 " (2.61 ") "	5.1 "
5	2 " (1.36 ") Heptane	6.4 "

* = the normal secondary alcohol, the so-called capryl alcohol, $CH_3(CH_2)_5CH(OH)CH_3$.

DISTRIBUTION OF CRESOL BETWEEN WATER AND ETHER. (Vaubel, 1903.)

Composition of Solvent.	Gms. Cresol in H_2O Layer.	In Ether Layer.
200 cc. H_2O+100 cc. Ether	0.0570	1.0760
200 cc. H_2O+200 cc. Ether	0.0190	1.1144

FREEZING-POINT LOWERING DATA (Solubility, see footnote, p. 1) FOR MIXTURES OF *o*, *m* AND *p* CRESOL (each determined separately) AND OTHER COMPOUNDS.

Mixture.	Authority.
o, *m* and *p* Cresol + Dimethylpyrone	(Kendall, 1914)
" " + Picric Acid	(Kendall, 1916)
" " + Pyridine	(Hatcher and Skirrow, 1917.)
o and *p* " + "	(Bramley, 1916)
" " + Sulfuric Acid	(Kendall and Carpenter, 1914)
o, *m* and *p* " + Urea	(Kremann, 1907)
Trinitrocresol + Naphthalene	(Saposchnikow and Gelvich, 1903, 1904.)

CROTONIC ACIDS $\alpha = CH_3CH:CHCOOH$, $\beta = HCH_3C:CHCOOH$.

FREEZING-POINT LOWERING DATA FOR MIXTURES OF CROTONIC ACIDS AND OF CROTONIC ACID AND OTHER COMPOUNDS.

Mixture.	Authority.
α Crotonic Acid + β Crotonic Acid	(Morrell and Hanson, 1904)
" " + Dimethylpyrone	(Kendall, 1914)
" " + Sulfuric Acid	(Kendall and Carpenter, 1914)
Chlorocrotonic Acid + Dimethylpyrone	(Kendall, 1914)
" " + Sulfuric Acid	(Kendall and Carpenter, 1914.)

Methyl **CRYPTOPINES**, *A*, *B* and *C* forms, $C_{22}H_{25}O_5N$.

The solubilities of the three forms in benzene, determined by lowering of the freezing-point, are: 5 gms. *A* form per liter at 5°, 30 gms. *B* form and 110 gms. *C* form. (Sidgwick, 1915.)

CUMINIC ACID $C_3H_7C_6H_4.COOH$ (*p* Isopropyl Benzoic Acid).

SOLUBILITY IN WATER AT 25°. (Paul, 1894)

1000 cc. sat. solution contain 0.1519 gm. or 0.926 millimol cuminic acid.

Pseudo**CUMIDINE** $(CH_3)_3.C_6H_2.NH_2$ (*s*, 5 Amino, 1. 2. 4, Trimethyl Benzene).

SOLUBILITY IN WATER.
(Lowenherz, 1898)

t°.	19.4°.	23.7°.	28.7°.
Gms. ψ Cumidine per liter H_2O	1.198	1.330	1.498

CYANAMIDE $CN.NH_2$.

SOLUBILITY IN WATER, DETERMINED BY FREEZING-POINT METHOD.
(Pratolongo, 1913)

t° of Congealing.	Gms. $CN.NH_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t° of Congealing.	Gms. $CN.NH_2$ per 100 Gms. Sat. Sol.	Solid Phase.
− 0.62	2.58	Ice	−14.39	40.19	$CN.NH_2$
− 3.96	9.42	"	− 2.49	56.80	"
− 7.58	18.40	"	+14.50	77.20	"
−12.72	30.9	"	25.6	87.15	"
−16.6 Eutec.	37.8	" + $CN.NH_2$	37.90	96.77	"
−15.6	38.75	$CN.NH_2$	42.9	100	"

Similar data for $CN.NH_2$ + urea and $CN.NH_2$ + dicyandiamide are also given.

DICYANDIAMIDINE Perchlorate $C_2H_6N_4OHClO_4$.

100 gms. H_2O dissolve 9.97 gms. of the salt at 17° (*d* sat. sol. = 1.039). (Carlson, 1910.)

CYANOGEN $(CN)_2$.

SOLUBILITY IN WATER AND OTHER SOLVENTS.
(Berthelot, 1904.)

The determinations were made over mercury with exclusion of air. The mercury was not attacked by the $(CN)_2$. On account of polymerization, the solubility increased with time of contact and amount of agitation of the mixture.

One volume of H_2O at 30° dissolves 3.5 vols. $(CN)_2$ after 2 hours, and 9.7 vols. after 97 hours.

One volume of abs. alcohol at 20° dissolves 26 vols. $(CN)_2$ immediately; 39 vols. after 4 hours; 89 vols. after 48 hrs. and 223 vols. after 4 days.

One volume glacial acetic acid dissolves 42 vols. of $(CN)_2$ immediately and 50.5 vols. after 3 days.

One volume of chloroform dissolves about 19 vols. $(CN)_2$ immediately and 29-30 vols. with time.

One volume of benzine finally dissolves 28 vols. $(CN)_2$.

One volume of rectified turpentine dissolves 9-10 vols. of $(CN)_2$.

One volume of ether dissolves 5 vols. $(CN)_2$ at 20°. (Gay Lussac.)

CYCLOHEXANE (Hexamethylene, Hexahydrobenzene) $CH_2 < (CH_2.CH_2)_2 > CH_2$.

Freezing-point data (solubility, see footnote, p. 1) for mixtures of cyclohexane and ethylene bromide are given by Baud (1913b). Results for mixtures of cyclohexane and methyl alcohol are given by Lecat (1909). Results for mixtures of cyclohexane and piperidine are given by Mascarelli and Constantino (1909, 1910).

CYCLOHEXANOL $(CH_2)_5.CHOH$.

100 gms. H_2O dissolve 5.67 gms. cyclohexanol at 11°. (de Forcrand, 1912)
100 gms. cyclohexanol dissolve 11.27 gms. H_2O at 11°. "

RECIPROCAL SOLUBILITY OF CYCLOHEXANOL AND WATER, DETERMINED BY THE FREEZING-POINT METHOD.
(de Forcrand, 1912)

t° of Solidification.	Gm. $(CH_2)_5$ CHOH per 100 Gms. Mixture.	t° of Solidification.	Gm $(CH_2)_5$CHOH per 100 Gms. Mixture.
+22.45	100	−57.4 Eutec.	95.030
17.48	99.767	−43.2	93.150
− 1.40	98.817	−33	91.962
−34.10	96.868	−18.50	90.980
−46.80	95.910	−14.58	90.36
−55.70	95.170	−12.05	88.73

Freezing-point data for mixtures of cyclohexanol and phenol are given by Mascarelli and Pestalozza, 1908, 1909.

CYCLOHEXANONE $(CH_2)_5:CO$.

Freezing-point data for mixtures of cyclohexanone and phenol are given by Schmidlin and Lang, 1910.

CYTISINE (Ulexine) $C_{11}H_{16}N_2O$ (m. pt. 151°-151.5°).

SOLUBILITY IN SEVERAL SOLVENTS AT 15°.
(Van de Moer, 1891.)

Solvent.	Gms. $C_{11}H_{16}N_2O$ per 100 Gms. Sat. Sol.	Solvent.	Gms. $C_{11}H_{16}N_2O$ per 100 Gms. Sat. Sol.
Water	soluble in all proportions	Benzine	1.26
Alcohol	" " "	Petroleum Ether	insol.
Chloroform	" " "	Amyl Alcohol	0.303
Ether (d 0.725)	0.302	Carbon Disulfide	insol.
Ether, abs.	insol.	Ethyl Acetate	very soluble

DEXTRIN $C_{12}H_{20}O_{10}$.

SOLUBILITY IN WATER. (Lewis, 1914.)

"In the case of dextrin, however, no matter how small an amount of water be employed, under no condition does the concentration of the solution remain constant, while on the other hand the addition of further solvent, never fails to dissolve additional dextrin, although the use of no amount of water, however large, will dissolve the whole of the sample."

100 gms. pyridine dissolve 65.44 gms. dextrin at 20–25°. (Dehn, 1917.)
100 gms. aq. 50% pyridine dissolve 102 gms. dextrin at 20–25°. "

DIACETYL TARTARIC ETHER (m. pt. 104°) **DIACETYL RACEMIC ETHER** (m. pt. 84°).

Freezing-point lowering data for each of these compounds in ethylene bromide and in *p* xylene are given by Bruni and Finzi, 1905.

DIBENZYL $C_6H_5.CH_2.CH_2.C_6H_5$.

Freezing-point lowering data for mixtures of dibenzyl and stilbene are given by Garelli and Calzolari, 1899.

DIDYMIUM Ammonium **NITRATE** $Di(NO_3)_3.2NH_4NO_3$.

100 gms. H_2O dissolve 292 gms. of the salt at 15°. (Holmberg, 1907.)

DIDYMIUM SULFATE $Di_2(SO_4)_3$.

SOLUBILITY IN WATER. (Marignac, 1853.)

t°.	Gms. $Di_2(SO_4)_3$ per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. $Di_2(SO_4)_3$ per 100 Gms H_2O.	Solid Phase.
12	43.1	$Di_2(SO_4)_3$	?	34.0	$Di_2(SO_4)_3.6H_2O$
18	25.8	"	19	11.7	$Di_2(SO_4)_3.8H_2O$
25	20.6	"	40	8.8	"
38	13	"	50	6.5	"
50	11	"	100	1.8	"

DIDYMIUM POTASSIUM SULFATE $K_2SO_4.Di_2(SO_4)_3.2H_2O$. (Marignac.)

100 gms. H_2O dissolve 1.6 grams of the double salt at 18°.

DIDYMIUM SULFONATES.

SOLUBILITY IN WATER. (Holmberg, 1907.)

Salt.	Formula.	t°.	Gms. Anhydrous Salt per 100 Gms. H_2O.
Didymium Benzene Sulfonate	$Di(C_6H_5SO_3)_3.9H_2O$	15	53.1
" *m* Nitro Benzene Sulfonate	$Di(C_6H_4(NO_2)SO_3)_3.6H_2O$	15	47.8
" *m* Chloro " "	$Di(C_6H_4ClSO_3)_3.9H_2O$	15	12 7
" *m* Bromo " "	$Di(C_6H_4BrSO_3)_3.9H_2O$	15	14.3
" Chloro Nitro " "	$Di(C_6H_4Cl(NO_2)SO_3{}^*)_3.16H_2O$	15	25 3
" α Naphthalene Sulfonate	$Di(C_{10}H_7SO_3)_3.6H_2O$	15	6 1
" 1.5 Nitro " "	$Di(C_{10}H_6(NO_2)SO_3)_3.6H_2O$	15	0.52
" 1.6 " "	$Di(C_{10}H_6(NO_2)SO_3)_3.9H_2O$	15	0.18
" 1.7 " "	$Di(C_{10}H_6(NO_2)SO_3)_3.9H_2O$	15	1.3

* (SO_3:NO_2:Cl = 1.3.6.)

DIETHYLAMINE see **ETHYLAMINE,** page 294.

DIONINE (Ethyl Morphine) $C_{19}H_{23}NO_3$.

100 cc. H_2O dissolve 0.2613 gm. $C_{19}H_{23}NO_3$ at 20°. (Zalai, 1910.)
100 cc. oil of sesame dissolve 0.5144 gm. $C_{19}H_{23}NO_3$ at 20°. "

DIPHENYL $C_6H_5.C_6H_5$.

100 grams absolute methyl alcohol dissolve 6.57 grams at 19.5°.
100 grams abs. ethyl alcohol dissolve 9.98 grams at 19.5°. (de Bruyn, 1892.)

Freezing-point data (Solubility, see footnote, p. 1) are given for mixtures of diphenyl + naphthalene by Washburn and Read (1915) and by Vignon (1891). Results for diphenyl + phenanthrene and for diphenyl + triphenylmethane are given by Vignon (1891).

DIPHENYLAMINE $(C_6H_5)_2NH$.

RECIPROCAL SOLUBILITY OF DIPHENYLAMINE AND WATER, BY SYNTHETIC METHOD.
(Campetti and del Grosso, 1913.)

t°.	Gms. $(C_6H_5)_2NH$ per 100 Gms. Mixture.	t°.	Gms. $(C_6H_5)_2NH$ per 100 Gms. Mixture.	t°.	Gms. $(C_6H_5)_2NH$ per 100 Gms. Mixture.
231	1.48	305 crit. t.	47.5	239	88.28
264	3.49	304	62.52	229	90.23
275	5.62	299	73.07	210	92.93
297	16.50	289	82.08	152	97.19
303	45.16	249	86.73		

Similar data for the systems diphenylamine + ether and diphenylamine + isopentane are given by Campetti, 1917.

SOLUBILITY OF DIPHENYLAMINE IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. $(C_6H_5)_2NH$ per 100 Gms. Solvent.	Authority.
Water	20–25	0.03	(Dehn, 1917.)
Methyl Alcohol	14.5	45.2	(Timofeiew, 1894.)
" "	19.5	57.5	(de Bruyn, 1892.)
Ethyl Alcohol	14.5	39.4	(Timofeiew, 1894.)
" "	19.5	56	(de Bruyn, 1892.)
Propyl Alcohol	14.5	29.4	(Timofeiew, 1894.)
Pyridine	20–25	302	(Dehn, 1917.)
Aq. 50% Pyridine	20–25	two layers formed	"

SOLUBILITY OF DIPHENYLAMINE AND ALSO OF TRIPHENYLAMINE IN CARBON DISULFIDE. (Arctowski, 1895.)

$NH(C_6H_5)_2$ in CS_2		$N(C_6H_5)_3$ in CS_2.	
t°.	Gms. per 100 Gms. Solution.	t°.	Gms. per 100 Gms. Solution.
−88½	0.87	−83	1.91
−117	0.37	−91	1.56
		−102	1.24
		−113½	0.98

SOLUBILITY OF DIPHENYLAMINE IN HEXANE AND IN CARBON DISULFIDE.
(Etard, 1894.)

t°.	Gms. $NH(C_6H_5)_2$ per 100 Gms. Sol in: Hexane.	CS_2.	t°.	Gms. $NH(C_6H_5)_2$ per 100 Gms. Sol. in: Hexane.	CS_2.
−60	...	1.3	0	2.6	33.7
−50	...	2.2	+10	3.8	46.8
−40	...	3.8	20	6.7	60.9
−30	0.5	7.2	30	13.8	76
−20	0.8	12.5	40	47	...
−10	1.4	21.6	50	94	...

FREEZING-POINT DATA FOR MIXTURES OF DIPHENYLAMINE AND OTHER COMPOUNDS.

Diphenylamine	+ Acetyldiphenylamine	(Böeseken, 1912.)
"	+ Ethylene Bromide	(Dahms, 1895.)
"	+ Naphthalene	(Roloff, 1895; Vignon, 1891.)
"	+ α Naphthylamine	(Vignon, 1891.)
"	+ Nitronaphthalene	(Battelli and Martinetti, 1885.)
"	+ α and β Naphthol	(Vignon, 1891.)
"	+ Paraffin	(Palazzo and Battelli, 1883.)
"	+ Phenanthrene	(Narbutt, 1905.)
"	+ Phenol	(Philip, 1903.)
"	+ Resorcinol	(Vignon, 1891.)
"	+ p Nitrotoluene	(Giua, 1915.)
"	+ 2.4 Dinitrotoluene	"
"	+ α Trinitrotoluene	"
"	+ p Toluidine	(Vignon, 1891.)
"	+ Urethan	(Pushin and Grebenschikov, 1913.)
Diphenylmethylamine	+ Phenol	(Bramley, 1916.)
"	+ o Chlorophenol	"
Hexanitrodiphenylamine	+ α Trinitrotoluene	(Giua, 1915.)

DIPHENYLAMINE BLUE.

SOLUBILITY IN SEVERAL SOLVENTS AT 23°.

(Szathmary de Szachinar, 1910.)

Solvent.	Gms Diphenylamine Blue per 100 Gms. Sat. Sol.	Solvent.	Gms. Diphenylamine Blue per 100 Gms Sat. Sol.
Methyl Alcohol	0.385	Acetone	0.177
Ethyl "	0.230	Aniline	0.395
Amyl "	0.049		

DIPHENYL SULFIDE $(C_6H_5)_2S$, etc.

Freezing-point lowering data for mixtures of $(C_6H_5)_2S + (C_6H_5)_2Se$, $(C_6H_5)_2S + (C_6H_5)_2Te$, $(C_6H_5)_2S + (C_6H_5)_2O$, $(C_6H_5)_2Se + (C_6H_5)_2Te$, are given by Pascal (1912).

DYES.

Data for the distribution of 12 dyes between water and isobutyl alcohol at 25°, are given by Reinders and Lely, Jr. (1912).

DYSPROSIUM OXALATE $Dy_2(C_2O_4)_3.10H_2O$.

100 cc. aq. 20% methylamine oxalate dissolve 0.276 gm. $Dy_2(C_2O_4)_3$. (Grant and James, 1917.)
" " ethylamine " " 1.787 " "
" " triethylamine " " 1.432 " "

EDESTIN and Edestin Salts.

SOLUBILITY IN AQ. SALT SOLUTIONS AT 25°.

(Osborne and Harris, 1905.)

The determinations were made by shaking an excess of the air-dry preparation with 20 cc. of the salt solution, allowing the globulin to settle and determining nitrogen in 10 cc. of the clear supernatant solution. The edestin or edestin salt was calculated from the N. The results are given in the form of curves. The following figures were read from the curve for the solubility of neutral edestin in aq. NaCl.

Gms. NaCl per 20 cc. Solvent →	0.468	0.585	0.702	0.818	0.935
Gm. Edestin per 20 cc. Sat. Sol. →	0.25	0.55	0.92	1.25	1.45

Curves are also given for the solubility of edestin in aqueous solutions of many other salts and of the solubility of edestin chloride, bichloride and sulfate in aq. sodium chloride solutions.

100 gms. pyridine dissolve 0.07 gm. edestin at 20-25°. (Dehn, 1917.)
100 gms. aq. 50% pyridine dissolve 9.05 gm. edestin at 20-25°. "

ELATERIN $C_{20}H_{28}O_5$.

100 cc. 90% alcohol dissolve 0.09 gm. elaterin at 15–20. (Squire and Caines, 1905.)
100 cc. chloroform dissolve 4 gms. elaterin at 15–20. " "

EMETINE and Salts.

SOLUBILITY IN WATER.
(Carr and Pyman, 1914.)

Salt.	Formula.	t°.	Gms. Hydrated Salt per 100 cc. Sat. Sol.
Emetine Hydrochloride	$C_{29}H_{40}O_4N_2.2HCl.7H_2O$	18	13.1
" Hydrobromide	$C_{29}H_{40}O_4N_2.2HBr.4H_2O$	17–18	1.9
" Nitrate	$C_{29}H_{40}O_4N_2.2HNO_3.3H_2O$	17–18	3.7
" Sulfate	$C_{29}H_{40}O_4N_2.H_2SO_4.7H_2O$	17–18	more than 100

ERBIUM OXALATE $Er_2(C_2O_4)_3.14H_2O$.

SOLUBILITY IN AQ. SULFURIC ACID AT 25°.
(Wirth, 1912.)

Normality of Aq. H_2SO_4.	Gms per 100 Gms. Sat. Sol. Er_2O_3	$Er_2(C_2O_4)_3$.	Solid Phase.
2.16	0.329	0.5144	$Er_2(C_2O_4)_3.14H_2O$
3.11	0.493	0.7708	"
4.32	0.7036	1.10	"
6.175	1.10	1.72	"

ERBIUM Dimethyl **PHOSPHATE** $Er_2[(CH_3)_2PO_4]_6$.

100 gms. H_2O dissolve 1.78 gm. $Er_2[(CH_3)_2PO_4]_6$ at 25°. (Morgan and James, 1914.)

ERBIUM SULFATE $Er_2(SO_4)_3.8H_2O$.

SOLUBILITY IN WATER AND AQ. H_2SO_4 AT 25°.
(Wirth, 1912.)

Normality of H_2SO_4.	Gms. per 100 Gms. Sat Sol. Er_2O_3.	$Er_2(SO_4)_3$.	Solid Phase.	Normality of H_2SO_4.	Gms. per 100 Gms. Sat Sol Er_2O_3.	$Er_2(SO_4)_3$.	Solid Phase.
Water alone	7.339	11.94	$Er_2(SO_4)_3.8H_2O$	2.16	3.98	6.473	$Er_2(SO_4)_3.8H_2O$
0.1	7.389	12.02	"	6.175	0.9352	1.521	"
0.505	6.249	10.164	"	12.6	0.0852	0.1386	"
1.1	5.256	8.549	"				

ERBIUM Bromonitrobenzene **SULFONATE** $Er(C_6H_3Br.NO_2.SO_3, 1.4.2)_3.12H_2O$.

100 gms. sat. solution in water contain 6.056 gms. anhydrous salt at 25°. (Katz and James, 1913.)

ERUCIC ACID $C_8H_{17}CH:CH(CH_2)_{11}COOH$.

SOLUBILITY IN ALCOHOLS.
(Timofeiew, 1894.)

Alcohol.	t°.	Gms. Erucic Acid per 100 Gms. Sat. Sol.	Alcohol.	t°.	Gms. Erucic Acid per 100 Gms. Sat. Sol.
Methyl Alcohol	−2	2.25	Ethyl Alcohol	+21.4	63.4
" "	+18	60.4	Propyl Alcohol	−2	10.2
" "	21.4	62	" "	+18	60.5
Ethyl Alcohol	−2	8.24	" "	21.4	63

ERYTHRITOL $(CH_2OH.CHOH)_2$.

100 gms. H_2O dissolve 61.5 gms. erythritol at 20–25°. (Dehn, 1917)
100 gms. aq. 50% pyridine dissolve 8.47 gms. erythritol at 20–25°. "
100 gms. pyridine dissolve 2.50 + gms. erythritol at 20–25. (Dehn, 1917; Holty, 1905.)

ETHANE C_2H_6.

SOLUBILITY IN WATER.
(Winkler, 1901)

t°.	β.	β'.	q.	t°.	β.	β'.	q.
0	0.0987	0.0982	0.0132	40	0.0292	0.0271	0.0037
5	0.0803	0.0796	0.0107	50	0.0246	0.0216	0.0029
10	0.0656	0.0648	0.0087	60	0.0218	0.0175	0.0024
15	0.0550	0.0541	0.0073	70	0.0195	0.0135	0.0018
20	0.0472	0.0462	0.0062	80	0.0183	0.0097	0.0013
25	0.0410	0.0398	0.0054	90	0.0176	0.0054	0.0007
30	0.0362	0.0347	0.0049	100	0.0172	0.0000	0.0000

β = Absorption coefficient, *i.e.*, the volume of gas (reduced to 0° and 760 mm.) absorbed by 1 volume of the liquid when the pressure of the gas itself without the tension of the liquid amounts to 760 mm.

β' = Solubility, *i.e.*, the volume of gas (reduced to 0° and 760 mm.) which is absorbed by one volume of the liquid when the barometer indicates 760 mm. pressure.

q = the weight of gas in grams which is taken up by 100 grams of the pure solvent at the indicated temperature and a total pressure (that is, the partial pressure of the gas plus the vapor pressure of the liquid at the absorption temperature) of 760 mm.

Freezing-point data for mixtures of ethane and hydrochloric acid are given by Baume and Georgitses, 1912, 1914.

SOLUBILITY OF ETHANE IN SEVERAL ALCOHOLS AND OTHER SOLVENTS.
(McDaniel, 1911.)

Solvent.	t°.	Abs. Coef. A.	Bunsen Coef B.	Solvent.	t°.	Abs. Coef A.	Bunsen Coef B
Methyl Alcohol (99%)	22.1	0.4436	0.4102	Amyl Alcohol	22	0.4532	0.4196
" "	30.2	0.4278	0.3883	" "	30.1	0.4444	0.4002
" "	40	0.3938	0.3436	Benzene	22.1	0.4954	0.4600
" "	49.8	0.2695	0.2278	"	35	0.4484	0.3976
Ethyl Alcohol (99.8%)	22.2	0.4628	0.4282	"	40.1	0.4198	0.3661
" "	30.1	0.4503	0.4051	"	49.9	0.3645	0.3081
" "	40	0.4323	0.3771	Toluene	25	0.4852	0.4450
Isopropyl Alcohol	21.5	0.4620	0.4275	"	30	0.4778	0.4300
" "	29.9	0.4532	0.4081	"	40.1	0.4675	0.4080
" "	40	0.4400	0.3837	"	50.2	0.4545	0.4013
" "	60.3	0.4244	0.3478	"	60	0.4502	0.3690

Abs. coef. A = vol. of ethane absorbed by unit volume of solvent at the temp. stated. For definition of Bunsen Coef. B, see β above, and also carbon dioxide, p. 227. Additional data for the solubility of ethane in amyl alcohol are given by (Friedel and Gorgeu, 1908).

ETHYL ACETATE $CH_3COOC_2H_5$.

SOLUBILITY OF ETHYL ACETATE IN WATER AND VICE VERSA.
(Merriman, 1913, see also Seidell, 1910)

Results for Ethyl Acetate in Water. / Results for Water in Ethyl Acetate.

t°.	$d_{\frac{t°}{4°}}$ of Sat. Sol.	Gms $CH_3COOC_2H_5$ per 100 Gms. H_2O.	t°.	$d_{\frac{t°}{4°}}$ of Sat. Sol	Gms H_2O per 100 Gms $CH_3COOC_2H_5$.
0	1.0034	11.21	0	0.9280	2.34
5	1.0022	10.38	10	0.9164	2.68
10	1.0009	9.67	20	0.9054	3.07
15	0.9995	9.05	25	0.9002	3.30
20	0.9979	8.53	30	0.8953	3.52
25	0.9962	8.08	40	0.8863	4.08
30	0.9943	7.71	50	...	4.67
40	0.9901	7.10	60	...	5.29

SOLUBILITY IN WATER AND IN AQUEOUS SALT SOLUTIONS AT 28°.

(Euler — Z. physik. Chem. 31, 365, '99; 49, 306, '04.)

Solvent.	Conc. of Salt Solution. Normality.	Gms per Liter.	$CH_3COOC_2H_5$ per Liter. Gram Mols.	Grams.	Solvent.	Conc. of Salt Solution. Normality.	Gms. per Liter.	$CH_3COOC_2H_5$ per Liter. Gram Mols.	Grams.
Water	0	0	0.825	75.02	NaCl(at 18°)	¼	14.62	0.76	67.0
KNO_3	½	50.59	0.77	67.81	" "	½	29.25	0.67	59.0
"	1	101.19	0.72	63.40	" "	1	58.5	0.51	45.0
"	2	202.38	0.625	55.04	Na_2SO_4	1	71.08	0.465	40.96
KCl	¼	18.4	0.747	65.79	" (at 18°)	½	35.54	0.61	54.0
"	½	36.8	0.685	65.33	" "	1	71.08	0.42	37.0
"	1	73.6	0.575	50.64	$MgSO_4$	¼	16.30	0.733	64.55
"	2	147.2	0.41	36.11	"	½	32.6	0.655	57.68
NaCl	¼	14.62	0.745	65.61	"	1	65.21	0.505	44.47
"	½	29.25	0.677	59.62	$ZnSO_4$	¼	20.18	0.733	64.55
"	1	58.5	0.545	47.99	"	½	40.36	0.653	57.50
"	2	117.0	0.315	27.74	"	1	80.73	0.500	44.03

Additional data for the influence of salts upon the solubility of ethyl acetate in water are given by Lundin, 1913.

SOLUBILITY OF ETHYL ACETATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°.

(Seidell, 1910.)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	cc. $CH_3COOC_2H_5$ per 100 cc. Solvent.	Gms. $CH_3COOC_2H_5$ per 100 Gms. Solvent.
0	0.999	10	8.6
5	0.993	10.5	9.5
10	0.986	12	10.9
15	0.974	15	13.3
20	0.960	27	19.6
25	0.945	44	37.0
30	0.931	70	66.7
35	0.918	125	132.5
40	...	∞	∞

SOLUBILITY OF ETHYL ACETATE IN AQUEOUS ETHYL ALCOHOL, METHYL ALCOHOL, AND ACETONE MIXTURES AT 20°.

(Bancroft — Phys. Rev. 3, 122, 131, '95-'96.)

In Ethyl Alcohol. Per 1 cc. C_2H_5OH. cc. H_2O.*	cc. $CH_3COOC_2H_5$.†	In Methyl Alcohol. Per 1 cc. CH_3OH. cc. H_2O.	cc. $CH_3COOC_2H_5$.	In Acetone. Per 1 cc. $(CH_3)_2CO$. cc. H_2O.	cc. $CH_3COOC_2H_5$.
10	0.25	10	1.08	10	1.01
8	0.27	3	0.68	5	0.60
4	0.35	1.5	1.69	2	0.43
2	1.02	1.29	2.50	1.5	0.47
1.06	2.50	1.0	4.9	1.0	0.63
0.65	5.0	0.98	7.0	0.8	0.74
0.54	7.0	1.0	8.0	0.51	1.00
0.44	10.0	1.03	10.0	0.25	2.00
				0.29	5.00

* Saturated with ethyl acetate. † Saturated with water.

Data for the distribution of ethyl acetate between petroleum and water, benzene and water, and benzene and a large number of aqueous solutions, at various temperatures, are given by Philip and Bramley, 1915.

Reciprocal Solubility of Ethyl Alcohol and Water at Low Temperatures, Determined by the Freezing-point Method.

(Pictet and Altschul, 1895; Pickering, 1893)

t°. of Freezing.	Sp. Gr. Sat. Sol.	Gms. C_2H_5OH per 100 Gms. Sat. Sol.	Solid Phase.	t°. of Freezing.	Sp. Gr. Sat. Sol.	Gms. C_2H_5OH per 100 Gms. Sat. Sol.	Solid Phase.
− 1	0.9962	2.5	Ice	− 23.6	0.9512	33.8	Ice
− 2	0.9916	4.8	"	− 28.7	0.9417	39	"
− 3	0.9870	6.8	"	− 33.9	0.9270	46.3	"
− 5	0.9824	11.3	"	− 41	0.9047	56.1	"
− 6.1	0.9793	13.8	"	− 50	...	68	"
− 8.7	0.9747	17.5	"	− 60	...	75	"
− 9.4	0.9732	18.8	"	− 70	...	80	"
−10.6	0.9712	20.3	"	− 80	...	83.5	"
−12.2	0.9689	22.1	"	−100	...	89.5	"
−14	0.9662	24.2	"	−118 Eutec.	...	93.5	" + C_2H_5OH
−16	0.9627	26.7	"	−115	...	96	C_2H_5OH
−18.9	0.9578	29.9	"	−110.5	...	100	"

The result for the eutectic and for the f.-pt. of C_2H_5OH are by Puschin and Glagoleva, 1914, 1915; the other data for concentrations of C_2H_5OH above 70% were obtained by exterpolation. Additional data for the freezing-point lowering are given by Rozsa (1911).

Freezing-point lowering data for mixtures of ethyl alcohol and hydrochloric acid are given by Maass and McIntosh, 1913.

The distribution coefficient of ethyl alcohol between amylalcohol and water was found by Fontein (1910) to be 1.13 at 15.5° and 1.21 at 28°.

Miscibility of Ethyl Alcohol with Mixtures of:

Benzaldehyde and Water at 0°.

(Bonner, 1910)

Composition of Homogeneous Mixtures.

Gms C_6H_5CHO.	Gms H_2O.	Gms C_2H_5OH.	Sp Gr of Mixture
0.957	0.043	0.159	1.02
0.898	0.102	0.283	1.01
0.800	0.200	0.420	0.99
0.700	0.300	0.550	0.98
0.598	0.402	0.601	0.97
*0.570	0.430	0.610	...
0.496	0.504	0.643	0.96
0.394	0.606	0.681	0.95
0.298	0.702	0.701	0.95
0.200	0.800	0.670	0.95
0.100	0.900	0.610	0.96
0.031	0.969	0.461	0.97

Benzene and Water at 15°.

(Bonner, 1910) (See also, p 125.)

Composition of Homogeneous Mixtures.

Gms C_6H_6.	Gms H_2O.	Gms C_2H_5OH.	Sp Gr. of Mixture.
0.987	0.013	0.170	0.86
0.937	0.063	0.356	0.87
*0.900	0.100	0.500	0.86
0.800	0.200	0.860	0.86
0.700	0.300	0.910	0.88
0.600	0.400	1.07	0.87
0.500	0.500	1.18	0.87
0.400	0.600	1.22	0.88
0.300	0.700	1.21	0.89
0.201	0.799	1.13	0.89
0.100	0.900	0.97	0.92
0.020	0.980	0.59	0.94

Note. — The determinations were made by gradually adding ethyl alcohol to the mixtures of the given amounts of water and the other constituent until a homogeneous solution was obtained. The results give the binodal curve for the system. The author also determined "tie lines" showing the compositions of various pairs of liquids which may exist in equilibrium. As the two layers approach each other in composition, the tie line is gradually shortened and finally reduced to a point, designated as the "plait point" of the binodal curve. This point is indicated by a * in the above tables. The mixtures above and below the * correspond, according to their Sp. Gr., to the upper and lower layers of the system. See also, last table p. 289.

The distribution coefficient of ethyl alcohol between benzene and water at 25° was found by Morgan and Benson (1907) to be 1.16. Additional data for this system are also given by Bubanovic. 1913 and by Taylor (1897).

MISCIBILITY OF ETHYL ALCOHOL (see Note, p. 287) WITH MIXTURES OF:

Bromobenzene and Water at 0°.
(Bonner, 1910.)
Composition of Homogeneous Mixtures.

Gms. C_6H_5Br.	Gms. H_2O.	Gms. C_2H_5OH.	Sp. Gr. Sat. Sol.
0.99	0.010	0.115	1.34
*0.96	0.040	0.32	...
0.90	0.10	0.65	1.07
0.80	0.20	1	0.96
0.70	0.30	1.19	0.96
0.60	0.40	1.30	0.98
0.50	0.50	1.39	0.95
0.40	0.60	1.43	0.91
0.30	0.70	1.43	0.92
*0.20	0.80	1.36	0.93
0.10	0.90	1.16	0.93
0.024	0.976	0.803	0.92

Nitrobenzene and Water at 15°.
(Bonner, 1910.)
Composition of Homogeneous Mixtures.

Gms. $C_6H_5NO_2$.	Gms. H_2O.	Gms. C_2H_5OH.	Sp. Gr. Sat. Sol.
0.965	0.035	0.248	1.08
*0.91	0.09	0.49	...
0.90	0.10	0.53	1.02
0.80	0.20	0.86	0.97
0.70	0.30	1.09	0.94
0.594	0.406	1.238	0.93
0.50	0.50	1.31	0.92
0.40	0.60	1.34	0.92
0.30	0.70	1.30	0.91
0.194	0.806	1.212	0.92
0.10	0.90	0.98	0.93
0.02	0.98	0.601	0.95

MISCIBILITY OF ETHYL ALCOHOL (see Note, p. 287) AT 0° WITH MIXTURES OF:

Benzyl Acetate and Water. (Bonner, 1910)
Composition of Homogeneous Mixtures.

Gms. $CH_3.CO_2.CH_2.C_6H_5$.	Gms. H_2O	Gms C_2H_5OH.	Sp Gr. Sat Sol
0.977	0.023	0.120	1.05
0.901	0.099	0.317	1.03
0.80	0.200	0.46	0.99
0.70	0.300	0.58	0.97
*0.68	0.32	0.60	...
0.60	0.40	0.69	0.95
0.50	0.50	0.78	0.94
0.40	0.60	0.85	0.94
0.30	0.70	0.88	0.93
0.20	0.80	0.88	0.93
0.10	0.90	0.80	0.94
0.041	0.959	0.665	0.95

Benzyl Alcohol and Water. (Bonner, 1910.)
Composition of Homogeneous Mixtures.

Gms $C_6H_5CH_2OH$.	Gms. H_2O.	Gms. C_2H_5OH.	Sp. Gr Sat. Sol.
0.90	0.10	0.13	1.03
0.80	0.20	0.26	1
0.70	0.30	0.35	0.98
0.60	0.40	0.39	0.98
0.50	0.50	0.40	0.97
0.40	0.60	0.41	0.97
*0.38	0.62	0.42	...
0.379	0.621	0.417	0.98
0.30	0.70	0.41	0.97
0.194	0.806	0.388	0.97
0.10	0.90	0.35	0.98
0.04	0.96	0.139	0.99

MISCIBILITY OF ETHYL ALCOHOL (see Note, p. 287) AT 0° WITH MIXTURES OF:

Benzylethyl Ether and Water.
(Bonner, 1910)
Composition of Homogeneous Mixtures.

Gms. $C_6H_5CH_2.O.C_2H_5$.	Gms. H_2O.	Gms. C_2H_5OH.	Sp. Gr. Sat. Sol.
0.971	0.029	0.189	0.94
0.90	0.10	0.37	0.92
0.80	0.20	0.54	0.92
0.70	0.30	0.67	0.91
*0.67	0.33	0.71	...
0.60	0.40	0.78	0.91
0.50	0.50	0.87	0.91
0.40	0.60	0.93	0.92
0.30	0.70	0.96	0.92
0.198	0.802	0.952	0.92
0.10	0.90	0.86	0.93
0.08	0.92	0.793	0.94

Carbon Tetrachloride and Water.
(Bonner, 1910)
Composition of Homogeneous Mixtures.

Gms. CCl_4.	Gms H_2O.	Gms C_2H_5OH.	Sp Gr. Sat Sol.
0.961	0.039	0.224	1.36
0.928	0.072	0.347	1.23
*0.92	0.08	0.39	...
0.90	0.10	0.45	1.20
0.80	0.20	0.67	1.15
0.70	0.30	0.82	1.07
0.60	0.40	0.94	1.03
0.499	0.501	1.04	1
0.40	0.60	1	0.97
0.25	0.75	1.105	0.95
0.10	0.90	1	0.92
0.032	0.968	0.745	0.93

DISTRIBUTION OF ETHYL ALCOHOL AT 25° (Bugarszky, 1910) BETWEEN:

Bromobenzene and Water. Gms. C_2H_5OH per Liter.		Carbon Tetrachloride and Water. Gms. C_2H_5OH per Liter.		Carbon Disulfide and Water. Gms. C_2H_5OH per Liter.	
C_6H_5Br Layer.	H_2O Layer.	CCl_4 Layer.	H_2O Layer.	CS_2 Layer.	H_2O Layer.
0.72	18.5	0.45	18.7	0.27	19.1
1.36	36.9	0.93	36.5	1.87	37.
2.68	68.2	2.55	68.1	10.23	69.3

MISCIBILITY OF ETHYL ALCOHOL (see Note p. 287) AT 0° WITH MIXTURES OF:

Chloroform and Water. (Bonner, 1910)

Composition of Homogeneous Mixtures.			
Gms. $CHCl_3$.	Gms. H_2O.	Gms C_2H_5OH.	Sp. Gr Sat. Sol.
0.907	0.093	0.434	1.19
0.90	0.10	0.45	1.18
0.80	0.20	0.60	1.12
0.70	0.30	0.68	1.07
0.593	0.407	0.726	1.04
0.501	0.499	0.729	1.03
*0.420	0.58	0.73	...
0.404	0.596	0.733	1.01
0.300	0.70	0.70	0.99
0.197	0.803	0.672	0.98
0.100	0.90	0.61	0.98
0.088	0.912	0.608	0.98

Diethylketone and Water. (Bonner, 1910)

Composition of Homogeneous Mixtures.			
Gms. $C_2H_5COC_2H_5$	Gms. H_2O.	Gms C_2H_5OH.	Sp Gr. Sat Sol.
0.938	0.062	0.136	0.85
0.900	0.10	0.19	0.85
0.895	0.105	0.201	0.86
0.800	0.20	0.31	0.87
0 781	0.219	0.317	0.87
0.702	0.298	0.356	0.88
0.600	0.400	0.392	0.89
0.547	0.453	0.410	0.90
0.499	0.501	0.411	0.91
0.458	0.542	0.415	0.92
0.407	0.593	0.404	0.91

Additional data for the miscibility of alcohol with chloroform + water mixtures are given by Miller and McPherson, 1908.

MISCIBILITY OF ETHYL ALCOHOL WITH MIXTURES OF ETHYL ETHER AND WATER AT 0°. (Corliss, 1914; Bonner, 1910; see also Kremann, 1910a)

Composition of the Lower Layer				Composition of Upper Layer.			
Gms $(C_2H_5)_2O$.	Gms. H_2O.	Gms C_2H_5OH	Sp. Gr. Sat Sol	Gms $(C_2H_5)_2O$	Gms H_2O.	Gms C_2H_5OH.	Sp Gr Sat Sol.
0.10	0.90	0.163	0.970	...	...	...	...
...	...	...	...	0.957	0.043	0.151	0.757
0.16	0.84	0.297	0.951	0.902	0.098	0.230	0.778
0.178	0.822	0.318	0.945	0.87	0.13	0.26	0.788
0.192	0.808	0.332	0.941	0.85	0.15	0.275	0.794
0.204	0.796	0.34	0.937	0.825	0.175	0.292	0.800
0.227	0.773	0.352	0.932	0.79	0.210	0.313	0.808
0.250	0.75	0.36	0.926	0.759	0.243	0.33	0.815
0.293	0.707	0.37	0.916	0.70	0.30	0.35	0.827
0.335	0.665	0.375	0.906	0.645	0.355	0.366	0.839
0.422	0.578	0.385	0.886	0.562	0.438	0.385	0.857
*0.49	0.51	0.385	0.874	0.49	0.51	0.385	0.874

The data for the binodal curve given by Corliss and by Bonner agree closely. The Sp. Gr. determinations of Corliss were made on larger amounts of solution and appear to be the more accurate. In addition, Corliss gives the specific gravities of each layer of a series of liquids in contact with each other, and from these and the binodal curve, the above data for the composition of the several conjugate layers have been calculated. Data are also given by Corliss for the distribution of colloidal arsenious sulfide between the two layers of the system.

Data for the distribution of ethyl alcohol between ether and water and between ether and molten $CaCl_2.6H_2O$ are given by Morgan and Benson (1907).

Miscibility of Ethyl Alcohol with Mixtures of Ethyl Ether and Water at 25°. (Horiba, 1911-12.)

Composition of Lower Layer.			Composition of Upper Layer.		
Gms. $(C_2H_5)_2O$.	Gms. H_2O.	Gms. C_2H_5OH.	Gms. $(C_2H_5)_2O$.	Gms. H_2O.	Gms. C_2H_5OH.
5.77	94.23	0	98.72	1.28	0
6.3	85.7	8	94.5	2.2	3.3
7.2	79.2	13.6	88.5	3.7	7.8
8	76	16	84.4	4.9	10.7
9.7	70.4	19.9	75.1	8.4	16.5
13.3	62.8	23.9	60.8	15.5	23.7
22.1	50.6	27.3	43.8	28.1	28.1
28.4	43.4	28.2	35.8	35.6	28.6
*31.6	40	28.4 (Plait point)	31.6	40	28.4

The binodal curve was determined in the usual way (see Note, p. 287). A series of conjugate liquids was then prepared and the Sp. Gr., refractive index and viscosity of each layer determined. From specially prepared curves for variations of physical constants with composition of mixture, the composition of the several conjugate liquids was ascertained. The results thus obtained, are given in the above table.

Data for the miscibility of ethyl alcohol with mixtures of water, ethyl ether and sulfuric acid at 0° and with mixtures of ethyl ether, water and ethylsulfuric acid at 0° are given by Kremann, 1910a.

Miscibility of Ethyl Alcohol (see Note p. 287) at 0° with Mixtures of:

Ethyl Acetate and Water. (Bonner, 1910.)

Composition of Homogeneous Mixtures.

Gms. $CH_3COOC_2H_5$.	Gms. H_2O.	Gms C_2H_5OH.	Sp. Gr. Sat. Sol.
0.92	0.080	0.100	0.91
0.90	0.10	0.13	0.91
0.799	0.201	0.228	0.93
0.699	0.301	0.265	0.92
0.60	0.40	0.29	0.95
0.50	0.50	0.30	0.95
*0.48	0.52	0.30	...
0.40	0.60	0.31	0.96
0.30	0.70	0.31	0.96
0.197	0.803	0.282	0.97
0.102	0.898	0.143	0.99

Ethyl Bromide and Water. (Bonner, 1910.)

Composition of Homogeneous Mixtures.

Gms. C_2H_5Br.	Gms. H_2O.	Gms. C_2H_5OH.	Sp. Gr. Sat. Sol.
0.967	0.033	0.240	1.23
0.90	0.10	0.37	1.15
*0.83	0.17	0.45	...
0.80	0.20	0.51	1.09
0.70	0.30	0.64	1.06
0.60	0.40	0.754	1.03
0.50	0.50	0.83	1
0.40	0.60	0.89	0.99
0.30	0.70	0.89	0.97
0.10	0.90	0.73	0.97
0.017	0.983	0.182	0.99

Miscibility of Ethyl Alcohol (see Note p. 287) at 0°, with Mixtures of:

Ethyl Butyrate and Water. (Bonner, 1910.)

Composition of Homogeneous Mixtures.

Gms. $C_3H_7COOC_2H_5$.	Gms. H_2O.	Gms. C_2H_5OH.	Sp Gr. Sat. Sol.
0.97	0.030	0.166	0.96
0.90	0.10	0.32	...
0.80	0.20	0.483	0.88
0.70	0.30	0.567	0.89
0.599	0.401	0.628	0.90
0.494	0.506	0.659	0.91
*0.46	0.54	0.67	...
0.40	0.60	0.69	0.92
0.297	0.703	0.693	0.93
0.193	0.807	0.684	0.94
0.10	0.90	0.63	0.94

Ethyl Propionate and Water. (Bonner, 1910.)

Composition of Homogeneous Mixtures.

Gms $C_2H_5COOC_2N_5$.	Gms. H_2O.	Gms. C_2H_5OH.	Sp. Gr. Sat. Sol.
0.977	0.023	0.138	0.90
0.90	0.10	0.27	0.90
0.80	0.20	0.38	0.90
0.695	0.305	0.453	0.92
0.60	0.40	0.49	0.91
0.50	0.50	0.52	0.92
*0.46	0.54	0.53	...
0.398	0.602	0.532	0.93
0.30	0.70	0.55	0.94
0.201	0.799	0.517	0.95
0.10	0.90	0.46	0.96

MISCIBILITY OF ETHYL ALCOHOL (see Note, p. 287) AT 0° WITH MIXTURES OF:

Ethylene Chloride and Water. (Bonner, 1910.)

Composition of Homogeneous Mixtures.

Gms. $CH_2Cl.CH_2Cl$.	Gms. H_2O.	Gms C_2H_5OH.	Sp. Gr. Sat. Sol.
0.971	0.029	0.191	1.15
0.90	0.10	0.42	1.08
*0.88	0.12	0.46	...
0.792	0.208	0.670	1.01
0.70	0.30	0.80	0.98
0.60	0.40	0.93	0.96
0.50	0.50	0.99	0.95
0.40	0.60	1.01	0.94
0.30	0.70	0.99	0.94
0.20	0.80	0.95	0.94
0.095	0.905	0.842	0.96
0.02	0.980	0.514	0.97

Ethylidene Chloride and Water. (Bonner, 1910.)

Composition of Homogeneous Mixtures.

Gms. $CH_3 CHCl_2$.	Gms. H_2O.	Gms. C_2H_5OH.	Sp Gr. Sat. Sol.
0.985	0.015	0.226	1.10
0.90	0.10	0.43	1.03
0.805	0.195	0.586	1.01
0.70	0.30	0.69	0.98
*0.67	0.33	0.72	...
0.60	0.40	0.77	0.96
0.50	0.50	0.82	0.95
0.437	0.563	0.857	0.94
0.30	0.70	0.88	0.93
0.20	0.80	0.86	0.93
0.10	0.90	0.79	0.94
0.03	0.97	0.576	0.95

MISCIBILITY OF ETHYL ALCOHOL (see Note, p. 287) AT 0° WITH MIXTURES OF:

Heptane and Water. (Bonner, 1910)

Composition of Homogeneous Mixtures.

Gms Heptane.*	Gms. H_2O	Gms C_2H_5OH	Sp. Gr. Sat Sol.
0.962	0.038	0.704	0.79
0.90	0.10	1.44	0.80
0.798	0.202	2.375	0.82
0.70	0.30	2.82	0.81
0.60	0.40	3.06	0.82
0.50	0.50	3.16	0.83
0.40	0.60	3.17	0.84
0.30	0.70	3.10	0.85
0.196	0.804	2.96	0.87
0.093	0.907	2.305	0.88

Hexane and Water. (Bonner, 1910.)

Composition of Homogeneous Mixtures.

Gms Hexane *	Gms. H_2O.	Gms. C_2H_5OH.	Sp. Gr. Sat Sol.
0.97	0.03	0.59	...
0.90	0.10	1.30	0.77
0.80	0.20	2.04	0.79
0.70	0.30	2.45	0.81
0.60	0.40	2.73	0.82
0.50	0.50	2.93	0.83
0.40	0.60	3.00	0.83
0.20	0.80	2.75	0.85
0.10	0.90	2.23	0.86
0.014	0.986	1.056	...

* Kahlbaum's Heptane and Hexane "aus Petroleum" were used.

MISCIBILITY OF ETHYL ALCOHOL (see Note, p. 287) AT 0° WITH MIXTURES OF:

Isoamyl Alcohol and Water. (Bonner, 1910)

Composition of Homogeneous Mixtures

Gms. $(CH_3)_2$-$CH(CH_2)_2OH$.	Gms. H_2O.	Gms C_2H_5OH.	Sp Gr Sat Sol
0.903	0.097	0.116	0.84
0.90	0.10	0.12	0.84
0.797	0.203	0.258	0.85
0.694	0.306	0.396	0.86
0.602	0.398	0.427	0.88
0.497	0.503	0.449	0.89
0.399	0.601	0.453	0.90
0.294	0.706	0.434	0.92
*0.27	0.73	0.43	...
0.196	0.804	0.411	0.94
0.10	0.900	0.369	0.96

Isobutyl Alcohol and Water. (Bonner, 1910)

Composition of Homogeneous Mixtures.

Gms $(CH_3)_2$-$CH CH_2OH$.	Gms H_2O	Gms C_2H_5OH	Sp Gr. Sat. Sol.
0.70	0.30	0.13	0.87
0.589	0.411	0.177	0.89
0.502	0.498	0.194	0.90
0.50	0.50	0.20	0.90
0.40	0.60	0.20	0.92
0.387	0.613	0.204	0.92
*0.35	0.65	0.21	...
0.304	0.696	0.205	0.94
0.30	0.70	0.21	0.94
0.20	0.80	0.20	0.95
0.132	0.868	0.189	0.96

MISCIBILITY OF ETHYL ALCOHOL (see Note, p. 287) AT 0° WITH MIXTURES OF:

Isoamyl Bromide and Water. (Bonner, '10.)

Composition of Homogeneous Mixtures.

Gms. $C_5H_{11}Br$.	Gms. H_2O.	Gms. C_2H_5OH.	Sp. Gr. Sat. Sol.
0.975	0.025	0.251	1.10
*0.96	0.04	0.36	...
0.90	0.10	0.68	1.01
0.80	0.20	1.09	0.96
0.70	0.30	1.37	0.94
0.60	0.40	1.57	0.93
0.498	0.502	1.676	0.91
0.40	0.60	1.75	0.91
0.30	0.70	1.75	0.91
0.20	0.80	1.71	0.91
0.10	0.90	1.46	0.92
0.022	0.978	1.027	0.93

Isobutyl Bromide and Water. (Bonner, '10.)

Composition of Homogeneous Mixtures.

Gms. $(CH_3)_2$-$CHCH_2Br$.	Gms. H_2O.	Gms. C_2H_5OH.	Sp. Gr. Sat. Sol.
0.976	0.024	0.200	1.18
*0.93	0.07	0.42	...
0.90	0.10	0.52	1.09
0.80	0.20	0.83	1.01
0.70	0.30	1.05	0.98
0.60	0.40	1.21	0.96
0.501	0.499	1.30	0.94
0.40	0.60	1.35	0.93
0.30	0.70	1.36	0.93
0.20	0.80	1.32	0.92
0.10	0.90	1.20	0.93
0.047	0.953	0.937	0.94

MISCIBILITY OF ETHYL ALCOHOL (see Note, p. 287) AT 0° WITH MIXTURES OF:

Isoamyl Ether and Water. (Bonner, '10)

Composition of Homogeneous Mixtures.

Gms $[(CH_3)_2$-$CH.CH_2CH_2]_2O$.	Gms. H_2O.	Gms C_2H_5OH.	Sp Gr. Sat. Sol.
0.958	0.042	0.368	0.81
0.90	0.10	0.70	0.82
*0.89	0.11	0.74	...
0.879	0.121	0.793	0.82
0.80	0.20	1.20	0.83
0.702	0.298	1.573	0.83
0.594	0.406	1.876	0.84
0.50	0.50	1.98	0.84
0.40	0.60	2.19	0.85
0.302	0.698	2.24	0.86
0.20	0.80	2.14	0.87
0.10	0.90	1.87	0.89

Mesitylene and Water. (Bonner, '10.)

Composition of Homogeneous Mixtures.

Gms $C_6H_3(CH_3)_3$.	Gms. H_2O	Gms C_2H_5OH.	Sp Gr. Sat. Sol.
*0.97	0.03	0.48	...
0.963	0.037	0.516	0.86
0.90	0.10	1.09	0.85
0.80	0.20	1.66	0.84
0.70	0.30	2.04	0.85
0.60	0.40	2.32	0.85
0.50	0.50	2.52	0.85
0.40	0.60	2.64	0.86
0.30	0.70	2.68	0.87
0.199	0.801	2.49	0.87
0.10	0.90	2.28	0.89
0.051	0.949	1.615	0.90

MISCIBILITY OF ETHYL ALCOHOL (see Note, p. 287) AT 0° WITH MIXTURES OF:

Methyl Aniline and Water. (Bonner, '10.)

Composition of Homogeneous Mixtures.

Gms. $CH_3NHC_6H_5$.	Gms. H_2O.	Gms C_2H_5OH.	Sp. Gr Sat. Sol.
0.959	0.041	0.218	0.96
0.90	0.10	0.37	0.95
0.795	0.205	0.555	0.93
0.70	0.30	0.68	0.93
*0.66	0.34	0.72	...
0.60	0.40	0.76	0.93
0.50	0.50	0.84	0.93
0.40	0.60	0.89	0.93
0.30	0.70	0.91	0.93
0.20	0.80	0.87	0.94
0.098	0.902	0.734	0.95
0.041	0.959	0.581	0.96

Phenetol and Water. (Bonner, '10.)

Composition of Homogeneous Mixtures.

Gms. $C_6H_5OC_2H_5$.	Gms. H_2O.	Gms. C_2H_5OH.	Sp. Gr. Sat. Sol.
0.992	0.18	0.157	0.96
*0.90	0.10	0.55	...
0.897	0.103	0.554	0.93
0.798	0.202	0.916	0.90
0.70	0.30	1.18	0.90
0.60	0.40	1.39	0.89
0.495	0.505	1.518	0.89
0.399	0.601	1.560	0.89
0.30	0.70	1.54	0.90
0.198	0.802	1.449	0.91
0.10	0.90	1.21	0.92
0.082	0.918	1.156	0.93

MISCIBILITY OF ETHYL ALCOHOL (see Note p. 287) AT 0° WITH MIXTURES OF:

Pinene and Water. (Bonner, 1910.)

Composition of Homogeneous Mixtures.

Gms. $C_{10}H_{16}$.	Gms. H_2O.	Gms. C_2H_5OH.	Sp. Gr. Sat. Sol.
0.99	0.010	0.268	0.87
*0.985	0.015	0.47	...
0.897	0.103	1.595	0.85
0.795	0.205	2.268	0.84
0.70	0.30	2.67	0.84
0.60	0.40	2.94	0.85
0.493	0.507	3.135	0.85
0.393	0.607	3.126	0.86
0.293	0.707	3.038	0.86
0.194	0.806	2.799	0.87
0.094	0.906	2.331	0.89
0.035	0.965	1.639	0.91

Propyl Bromide and Water. (Bonner, 1910.)

Composition of Homogeneous Mixtures.

Gms. $CH_3.CH_2.CH_2Br$.	Gms. H_2O.	Gms. C_2H_5OH.	Sp. Gr. Sat. Sol.
0.975	0.025	0.190	1.26
*0.92	0.08	0.42	...
0.90	0.10	0.50	1.12
0.80	0.20	0.72	1.06
0.70	0.30	0.88	1.02
0.60	0.40	1.01	0.99
0.50	0.50	1.10	0.98
0.40	0.60	1.15	0.96
0.30	0.70	1.14	0.95
0.204	0.796	1.12	0.94
0.096	0.904	1.02	0.94
0.027	0.973	0.687	0.95

MISCIBILITY OF ETHYL ALCOHOL (see Note p. 287) AT 0° WITH MIXTURES OF:

Toluene and Water. (Bonner, 1910)

Composition of Homogeneous Mixtures.

Gms $C_6H_5CH_3$.	Gms. H_2O.	Gms C_2H_5OH.	Sp Gr Sat Sol
0.948	0.052	0.388	0.87
0.90	0.10	0.61	0.86
0.80	0.20	0.95	0.86
0.70	0.30	1.21	0 86
0.60	0.40	1.41	0.86
0.50	0.50	1.53	0.87
0.40	0.60	1.59	0.87
0.30	0.70	1.56	0.88
0.20	0 80	1.44	0.89
0.10	0.90	1.23	0.91
0.028	0.972	0.817	0.94

o Toluidine and Water. (Bonner, 1910.)

Composition of Homogeneous Mixtures.

Gms. $CH_3C_6H_4NH_2$.	Gms. H_2O.	Gms. C_2H_5OH.	Sp. Gr. Sat. Sol.
0.954	0.046	0.025	1.01
0.90	0.10	0.21	0.93
0.80	0.20	0.32	0.97
0.70	0.30	0.41	0.96
0.60	0.40	0.455	0.96
0.50	0.50	0.48	0.96
0.40	0.60	0.50	0.96
0.30	0.70	0.50	0.96
0.20	0.80	0.49	0.96
0.098	0.902	0.462	0.98
0.027	0.973	0.262	...

MISCIBILITY OF ETHYL ALCOHOL (see Note p. 287) AT 0° WITH MIXTURES OF:

Bromotoluene (b. pt. 182–3) and Water. (Bonner, 1910)

Composition of Homogeneous Mixtures.

Gms $BrC_6H_4CH_3$.	Gms. H_2O.	Gms C_2H_5OH.	Sp Gr Sat. Sol.
0.98	0.02	0.33	...
0.951	0.049	0.522	1.09
0.90	0.10	0.87	1.06
0.80	0.20	1.28	0.97
0.70	0.30	1.54	0.94
0.60	0.40	1.71	0.93
0.50	0.50	1.81	0.92
0.40	0.60	1.89	0.91
0.30	0.70	1.89	0.90
0.20	0.80	1.78	0.90
0.10	0.90	1.533	0.91
0.033	0.967	1.307	0.92

p Nitrotoluene and Water. (Bonner, 1910)

Composition of Homogeneous Mixtures.

Gms $NO_2C_6H_4CH_3$.	Gms H_2O	Gms. C_2H_5OH.	Sp. Gr. Sat. Sol.
0 978	0.022	0.253	1.08
*0.95	0.05	0.50	...
0.90	0.10	0.84	0.97
0.80	0.20	1.29	0.96
0.70	0.30	1.57	0.92
0.60	0.40	1.73	0.91
0.506	0.494	1.782	0.91
0.398	0.602	1.868	0.91
0.294	0.706	1.816	0.91
0.20	0.80	1.63	0.91
0.10	0.90	1.30	0.92
0.056	0.944	1.105	0.93

MISCIBILITY OF ETHYL ALCOHOL (see Note p. 287) AT 0° WITH MIXTURES OF:

o Xylene and Water. (Bonner, 1910.)

Composition of Homogeneous Mixtures.

Gms. *o* $C_6H_4(CH_3)_2$.	Gms. H_2O.	Gms. C_2H_5OH.	Sp. Gr. Sat. Sol.
0.971	0.029	0.352	0.89
*0.96	0.04	0.53	...
0.90	0.10	0.93	0.87
0.786	0.214	1.32	0.87
0.70	0.30	1.53	0.87
0.60	0.40	1.72	0.87
0.50	0.50	1.87	0.87
0.40	0.60	1.96	0.88
0.30	0.70	1.94	0.88
0.20	0.80	1.81	0.89
0.031	0.969	1.19	0.93

m Xylene and Water. (Bonner, 1910.)

Composition of Homogeneous Mixtures.

Gms. *m* $C_6H_4(CH_3)_2$.	Gms. H_2O.	Gms. C_2H_5OH.	Sp. Gr. Sat. Sol.
0.967	0.033	0.388	0.88
0.90	0.10	0.81	0.87
0.80	0.20	1.30	0.85
0.70	0.30	1.61	0.86
0.60	0.40	1.77	0.86
0.50	0.50	1.90	0.87
0.40	0.60	1.98	0.87
0.30	0.70	2.01	0.88
0.20	0.80	1.87	0.89
0.10	0.90	1.53	0.90
0.023	0.977	1.168	0.92

Additional data for the system ethyl alcohol, *m* xylene, water at 0°, 19°, 41°, 63° and 100° are given by Holt and Bell, 1914.

p XYLENE AND WATER. (Bonner, 1910.)

Composition of Homogeneous Mixtures.

Gms. *p* $C_6H_4(CH_3)_2$.	Gms. H_2O.	Gms. C_2H_5OH.	Sp. Gr. Sat. Sol.
0.966	0.034	0.306	0.84
*0.92	0.08	0.57	...
0.90	0.10	0.65	0.85
0.80	0.20	1.05	0.85
0.70	0.30	1.35	0.85
0.60	0.40	1.56	0.85
0.50	0.50	1.68	0.86
0.40	0.60	1.77	0.86
0.292	0.702	1.743	0.87
0.193	0.807	1.625	0.88
0.100	0.90	1.39	0.89
0.015	0.985	0.863	0.93

The coefficient of distribution of ethyl alcohol between olive oil and water is 0.026 at 3° and 0.047 at 30°. (Meyer, 1901; 1909)

100 gms. cottonseed oil (0.922 Sp. Gr.) dissolve 22.9 gms. ethyl alcohol at 25°. 100 gms. ethyl alcohol dissolve 11.75 gms. cottonseed oil at 25°. (Wroth and Reid, '16.)

DISTRIBUTION OF ETHYL ALCOHOL BETWEEN COTTONSEED OIL AND WATER AT 25°. (Wroth and Reid, 1916.)

Gms C_2H_5OH per 100 cc Oil Layer.	Gms C_2H_5OH per 100 cc H_2O Layer.	Ratio.
0.2083	6.147	29.5
0.2251	6.738	29.9
0.2515	6.835	27.1
0.2783	6.876	24.7
0.3017	8.682	28.7

Data for the reciprocal solubility of ethyl alcohol and turpentine are given by Vèzes and Mouline, 1904, 1905-06.

Data for the system ethyl alcohol, water, petroleum are given by Rodt (1916).

ETHYLAMINES $C_2H_5.NH_2$, $(C_2H_5)_2NH$, $(C_2H_5)_3N$.

Freezing-point data (solubility, see footnote, p. 1) for mixtures of ethylamine + water, diethylamine + water, and triethylamine + water are given by Guthrie, 1884 and by Pickering, 1893.

The solubility of ethylamine and of diethylamine in water at 60°, calculated from the vapor pressures determined by an aspiration method, are given by Doyer, (1890) as follows:

Amine.	Vapor Pressure in mm. Hg.	Ostwald Solubility Ex. *l* (see p. 227.)	Bunsen Absorption Coef. (see p. 227.)
$C_2H_5NH_2$	64.5	321	263
$(C_2H_5)_2NH$	233	89	73

Data for the solubility of triethylamine in water at high pressures are given by Kohnstamm and Timmermans, 1913.

Solubilities of Di Ethyl Amine and Water.*

(Lattey — Phil. Mag. [6] 10, 398, '05.)

t°.	Gms. $NH(C_2H_5)_2$ per 100 Gms Aqueous Layer.	Amine Layer.
155	21.7	59.0
150	23.6	55.5
148	24.8	53.5
146	26.3	51.0
145	28.0	49.0
144	31.0	45.0
143.5 (crit. t.)	37.4	

Distribution of Tri Ethyl Amine between Water and Amyl Alcohol at 25°.

(Herz and Fischer — Ber. 37, 4751, '04.)

Gms. $N(C_2H_5)_3$ per 100 cc. Aqueous Layer.	Alcoholic Layer.	Millimols $N(C_2H_5)_3$ per 10 cc Aqueous Layer.	Alcoholic Layer.
0.0885	2.299	0.0875	2.273
0.1683	4.457	0.1664	4.408
0.1866	4.922	0.1846	4.868
0.2502	6.491	0.2474	6.418

TriethylAMINE $N(C_2H_5)_3$.

Solubility in Water.*

(Rothmund, 1898)

t°.	Gms. $N(C_2H_5)_3$ per 100 Gms Aq. Layer.	Amine Layer	t°.	Gms. $N(C_2H_5)_3$ per 100 Gms. Aq Layer.	Amine Layer
18.6 (crit. temp.)	51.9		40	3.65	96.48
20	14.24	72	50	2.87	96.4
25	7.30	95 18	55	2.57	96.3
30	5.80	96 60	60	2 23	96.3
35	4.58	96.5	65	1.97	96 3

Solubility of Triethylamine in Water and in Aq. Ethyl Alcohol at Different Temperatures.*

(Meerburg, 1902)

Water. t°.	Gm $N(C_2H_5)_3$ per 100 Gms. Sol.	13.33% Alcohol. t°.	Gm $N(C_2H_5)_3$ per 100 Gms. Sol.	28.98% Alcohol t°.	Gm $N(C_2H_5)_3$ per 100 Gms Sol	38.84% Alcohol t°.	Gm $N(C_2H_5)_3$ per 100 Gms Sol	60.16% Alcohol. t°	Gm $N(C_2H_5)$ per 100 Gms Sol.
69.2	1.7	38.3	8.2	54.5	22.8	73.4	31.2	76–77	71.2
30.8	5.6	31.7	13.9	45	29.8	65.4	33 3	74–75	75
23.1	8.5	28	21.6	33.4	51.1	51 6	40.6	72–73	80
18.7	25.8	26.4	30.6	31.4	63 7	42 1	50.6		
18.7	37.2	24.9	40.5	30 3	68.5	40 9	54 7		
19.5	51.8	24.2	49.8	28.5	82.2	34.2	70.6		
20.5	68.6	24.1	60.7	35	91.8	33	77.5		
20.5	84	24	69 7			34.7	88		
20.5	89.7	23.5	76.6			40.5	91.3		
21.2	92.4	24	81.5						
25.8	•95.5	24.2	87.4						
26.5	96.1	25	92						

NOTE. — Results for triethylamine, water and ethyl ether, and for triethylamine, water and phenol are also given by Meerburg.

100 gms. abs. methyl alcohol dissolve 57.5 gms. $NH(C_6H_5)_2$ at 19.5°.
100 gms. abs. ethyl alcohol dissolve 56 gms. $NH(C_6H_5)_2$ at 19.5°. (de Bruyn, 1892.)

* Determinations made by "Synthetic Method," see Note, p. 16.

DISTRIBUTION OF ETHYLAMINES BETWEEN WATER AND TOLUENE.
(Moore and Winmill, 1912.)

Amine.	Results at 18°. Gms. Equiv. per Liter Aq. Layer.	Partition Coef.	Results at 25°. Gms Equiv. per Liter Aq. Layer.	Partition Coef.	Results at 32.35°. Gms. Equiv. per Liter Aq. Layer.	Partition Coef.
$(C_2H_5)NH_2$	0.0756	26.09	0.1159	19.13	0.1287	14.76
"	0.0886	26.14	0.0999	19.11	0.2479	14.79
$(C_2H_5)_2NH$	0.0484	2.14	0.0483	1.59	0.1200	1.093
"	0.0503	2.14	0.0416	1.59	0.1104	1.095
$(C_2H_5)_3N$	0.0189	0.131	0.0104	0.099	0.0132	0.069
"	0.0191	0.131	0.0131	0.099	0.0133	0.069

Similar data for triethylamine at 25° and at other temperatures are given by Hantzsch and Sebaldt, 1899, and by Hantzsch and Vagt, 1901.

Data for ternary systems composed of triethylamine, water and each of the following compounds: naphthalene, cane sugar, KCl, K_2CO_3, K_2SO_4 and KSCN, are given by Timmermans (1907).

ETHYL, DiETHYL and TriETHYLAMINE HYDROCHLORIDES, etc.

SOLUBILITY OF EACH IN WATER AND IN CHLOROFORM AT 25°.
(Peddle and Turner, 1913.)

Amine Salt.		Formula.	Solubility in Water. Gms Amine Salt per 100 Gms. H_2O.	Solubility in $CHCl_3$. Gms. Amine Salt per 100 Gms. $CHCl_3$.
Ethylamine	Hydrochloride	$C_2H_5.NH_2.HCl$	279.9	0.17
Diethylamine	"	$(C_2H_5)_2NH.HCl$	231.7	29.45
"	Hydrobromide	$(C_2H_5)_2NH.HBr$	311.6	46.65
"	Hydroiodide	$(C_2H_5)_2NH.HI$	377.2	71.56
Triethylamine	Hydrochloride	$(C_2H_5)_3N.HCl$	137	17.37
"	Hydrobromide	$(C_2H_5)_3N.HBr$	150.6	23.44
"	Hydriodide	$(C_2H_5)_3N.HI$	370	92.2

ETHYL BROMIDE C_2H_5Br.

SOLUBILITY IN ETHER. (Parmentier, 1892.)

t°.	−13°.	0.	12.	22.5.	32.
Gms. C_2H_5Br per 100 gms. Ether	632	561	462	302	253

SOLUBILITY OF ETHYL BROMIDE, ETC., IN WATER.
(Rex, 1906)

Dissolved Substance.	Grams per 100 Grams H_2O at: 0°.	10°	20°.	30°.
Ethyl Bromide	1.067	0.965	0.914	0.896
Ethyl Iodide	0.441	0.414	0.403	0.415
Ethylene Chloride	0.922	0.885	0.869	0.894
Ethylidene Chloride	0.656	0.595	0.550	0.540

ETHYL BUTYRATE $C_3H_7COOC_2H_5$.

SOLUBILITY IN WATER AND IN AQUEOUS ETHYL ALCOHOL MIXTURES AT 20°.

100 g. H_2O dissolve 0.5 g. ethyl butyrate at 22°. (Traube, 1884.)
100 cc. H_2O dissolve 0.8 cc. ethyl butyrate at 20°. (Bancroft, 1895.)
100 cc. ethyl butyrate dissolve 0.4 − 0.5 cc. H_2O at 20°. "

Per 5 cc. Ethyl Alcohol						
	cc. H_2O	10	6	4	2.96	2.10
	cc. $C_3H_7COOC_2H_5$	0.34	0.96	2.47	4	6

ETHYL CARBAMATE (Urethan) $CO(OC_2H_5)NH_2$. See also p. 741.

SOLUBILITY IN SEVERAL SOLVENTS AT 25°. (U. S. P. VIII.)

Solvent.	Water.	Alcohol.	Ether.	Chloroform.	Glycerol.
Gms. $CO(OC_2H_5)NH_2$ per 100 gms. solvent	100+	166	100	77	33

ETHYL ETHER $(C_2H_5)_2O$.

Reciprocal Solubility of Ether and Water.

(Klobbie — Z. physik. Chem. 24, 619, '97; Schuncke — Ibid. 14, 334, '94, St. Tolloczko — Ibid. 20, 407, '96.)

t°.	Solubility of Ether in Water. Lower Layer — Aqueous. Gms. $(C_2H_5)_2O$ per 100 Gms. Water.	Solution.	Solubility of Water in Ether. Upper Layer — Ethereal. Gms. H_2O per 100 Gms. Ether.	Solution.
0	13.12	11.6	1.01	1.0
5	11.4	10.2	1.06	1 05
10	9 5	8.7	1.12	1.12 (2.6, S.)
15	8.2	7 6	1.16	1.15
20	6 95	6.5	1.20	1.20 (2.65, S.)
25	6 05	5.7	1.26	1.26
30	5.4	5.1	1.33	1.32
*40	4.7	4.5	1.52	1.50
*50	4 3	4.1	1 73	1.7
*60	3.8	3.7	1.83	1.8
*70	3.3	3.2	2.04	2 0
*80	2.9	2.8	2.25	2.2

* Indicates determinations made by Synthetic Method, for which see page 16.

100 cc. H_2O dissolve 8.11 cc. ether at 22°; vol. of solution, 107.145 cc., Sp. Gr. 0.9853.

100 cc. ether dissolve 2.93 cc. H_2O at 22°; vol. of solution, 103.282 cc.; Sp. Gr. 0.7164. (Herz, 1898.)

More recent determinations of the solubility of ethyl ether in water, agreeing closely with the above data, are given by Osaka, 1910.

Data for the temp.-pressure diagram of ether-water are given by Scheffer, 1912a.

Solubility of Ether in Aqueous Solutions of Hydrochloric Acid.

(Schuncke — Z. physik. Chem. 14, 334, '94; in 38 52% HCl, Draper — Chem. News, 35, 87, '77.)

t°.	In 38.52 % HCl. cc. Ether per 100 cc. Solvent.	In 31.61 % HCl. cc Ether per 100 cc. Solvent.	Gms. per 1 Gram H_2O. HCl.	$(C_2H_5)_2O$.	In 20 % HCl. cc Ether per 100 cc. Solvent.	Gms. per 1 g. H_2O. HCl.	$(C_2H_5)_2O$.
−6	181	149	0.4622	1 387	67 2	0 253	0 5637
0	177.5	142	0.4622	1 308	58 3	0 253	0.4863
+6	172.5	131.5	0.4622	1.2075	51.1	0.253	0.4231
15	163	121 7 (14°)	0 4622	1.1075	40.5	0.253	0.3299
20	158	111.9 (20.8°)	0 4622	1.0005	33 1	0.253	0.2688
26	135	104.2	0 4622	0.9360	27.5	0.253	0.2221

t°.	In 12.58 % HCl. cc. Ether per 100 cc. Solvent.	Gms per 1 Gram H_2O. HCl.	$(C_2H_5)_2O$.	In 3.65 % HCl. cc Ether per 100 cc. Solvent.	Gms. per 1 Gram H_2O. HCl.	$(C_2H_5)_2O$.
−6	26.45	0.144	0.2106	19.23	0.0308	0.1454
0	22.19	0.144	0.1748	...	...	...
+6	19.18	0.144	0.1503	14.31	0.0308	0.1070
15	15.61	0.144	0.1210	11.83	0.0308	0.0868
20	13.76	0.144	0.1059	10.52	0.0308	0.0769
26	12.70	0.144	0.0970	9.24	0.0308	0.0673

The above data are recalculated and discussed by Jüttner, 1901.

Data for the solubility of ethyl ether in carbon dioxide at high pressures are given by Sander (1911-12). The determinations were made by using quite small amounts of ether and observing the pressure at which a drop of liquid just appeared or disappeared in a mixture of known weight per cent composition. The results give the "gas curve" for constant temperature and when plotted in connection with the "liquid curve" (see CO_2, p. 233), give the complete pressure — concentration diagram.

Freezing-point lowering data for mixtures of ethyl ether and hydrochloric acid are given by Maass and McIntosh (1913).

SOLUBILITY OF ETHER IN AQUEOUS SALT, ETC., SOLUTIONS AT 18°.

(Euler, 1904.)

Aq. Solution of:	Gms. per Liter Added Salt.	Gms. $(C_2H_5)_2O$ per 100 cc. Solvent.	Aq. Solution of:	Gms. per Liter Added Salt.	Gms. $(C_2H_5)_2O$ per 100 cc. Solvent.
Water	0	7.8	Na_2SO_4	59.54	3.7
KNO_3	101.19	5.4	Mannite	91.06	6.7
KCl	73.6	4.7	H_2SO_4	49	6.6
LiCl	42.48	5.2	"	122.5	5.65
NaCl	58.5	4.5	"	245.	4.55

SOLUBILITY OF ETHYL ETHER IN AQ. SALT SOLUTIONS AT 28°.

(Thorin, 1915)

Solvent.	Gms. $(C_2H_5)_2O$ per 100 cc. Solvent.	Solvent.	Gms. $(C_2H_5)_2O$ per 100 cc. Solvent.	Solvent.	Gms. $(C_2H_5)_2O$ per 100 cc. Solvent.
Water	5.85	0.5 *n* Na_3PO_4	4.17	0.5 *n* Na Succinate	4.68
0.5 *n* NaI	5 70	0.5 *n* Na_3AsO_4	4.20	0 5 *n* Na Citrate	4.19
0.5 *n* NaBr	4.68	0.5 *n* $Hg(CN)_2$	5.71	0.5 *n* Na Acetate	4.15
0.5 *n* NaCl	4.48	0.5 *n* NH_4NO_3	5.37	0.5 *n* Na Tartrate	4.12
0.5 *n* NaF	4.15	0.5 *n* $FeCl_3$	5.09	0.5 *n* Na Phthalate	5.88
0.5 *n* Na_2SO_4	4.30	0.5 *n* $Na_2Cr_2O_7$	4.84	0.5 *n* Na Cinnamate	6.29
0.5 *n* Na_2CrO_4	4.22	0.5 *n* $FeSO_4$	4.33	0.5 *n* Na Benzoate	5.99
0.5 *n* Na_2MoO_4	4.39	0.5 *n* $Al_2(SO_4)_3$	3.95	0.5 *n* Na Salicylate	6.44
0.5 *n* Na_2WO_4	4.12	0.5 *n* Am. Oxalate	4.74	0.5 *n* Na Benzene Sulfonate	6.05

SOLUBILITY OF ETHYL ETHER IN 0.91 PER CENT (PHYSIOLOGICAL NORMAL SALINE) AQUEOUS NaCl SOLUTION.

(Bennett, 1912.)

Determinations made by freezing-point method. Ether of d_{15} = 0.720 used.

t°.	Gms. $(C_2H_5)_2O$ per 100 Gms. Aq NaCl.	cc. $(C_2H_5)_2O$ (at 15°) per 100 cc. Aq. NaCl.
0	13.08	18.27
5	11.15	15.58
10	9.45	13.20
15	8.10	11.31
20	6.87	9.60
25	5.96	8.33
30	5.30	7.40

Purified ether prepared from methylated spirit gave slightly higher results.

SOLUBILITY OF ETHYL ETHER IN AQ. SULFURIC ACID AT 0°.

(Kremann, 1910a.)

Gms. per 100 Gms. Homogeneous Mixture.			Gms. per 100 Gms. Homogeneous Mixture.		
$(C_2H_5)_2O$.	H_2O.	H_2SO_4.	$(C_2H_5)_2O$.	H_2O.	H_2SO_4.
24.2	34.5	41.3	16.1	42.7	41.2
24.8	35.4	39.8	6.1	78	15.9
43.9	15.7	40.4	53.8	8.5	37.7
34	26.1	39.9			

Data for the system ethyl ether, ethyl alcohol, water, sulfuric acid at 0° are also given.

SOLUBILITY OF ETHER IN AQUEOUS ETHYL ALCOHOL AND IN AQUEOUS METHYL ALCOHOL MIXTURES AT 20°.

(Bancroft, 1895.)

In Ethyl Alcohol.				In Methyl Alcohol.			
Per 5 cc. C_2H_5OH.		Per 5 cc. C_2H_5OH.		Per 1 cc. CH_3OH.		Per 1 cc. CH_3OH.	
cc. H_2O.*	cc. $(C_2H_5)_2O$.†	cc. H_2O.*	cc. $(C_2H_5)_2O$.†	cc. H_2O.	cc. $(C_2H_5)_2O$.	cc. H_2O.	cc. $(C_2H_5)_2O$.
50	1.30	4.45	7	10	1.13	0.83	1.80
25	1.70	4	7.8	7	0.85	0.64	3
10	2.41	3.87	8	4	0.60	0.52	5
8	3.35	3.10	10	2.5	0.56	0.44	10
6	5.10	2.08	15	1.8	0.63	0.45	15
5.21	6	1.77	17.5	1	1.23		

* Saturated with ether. † Saturated with water.

THE SYSTEM ETHYL ETHER–MALONIC ACID–WATER AT 15°. (Klobbie, 1897.)

Results for Conjugated Liquid Layers Formed when Insufficient Malonic Acid to Saturate the Solutions Was Present. Results for the Liquid Layers in Contact with Excess of Malonic Acid.

Gms. per 100 Gms. Lower Layer			Gms. per 100 Gms. Upper Layer.			Gms. per 100 Gms. Liquid			Solid Phase.
Malonic Acid.	H_2O.	Ethyl Ether.	Malonic Acid.	H_2O.	Ethyl Ether.	Malonic Acid.	H_2O.	Ethyl. Ether.	
0	92.23	7.77	0	1.20	98.80	8	0	92	Malonic Acid
4.63	87.42	7.94	0.72	1.54	97.74	9.96	0.42	89.61	"
11.60	79.92	8.48	2.19	1.99	95.82	19.41	2.79	77.80	"
20.45	69.55	9.99	5.01	3.08	91.91	27.22	5.23	67.54	"
27.43	60.57	12	9.52	5.19	85.29	35.51	10.73	53.75	"
33.63	47.45	18.80	21.89	13.42	64.91	46.48	20.86	32.66	"
34.17	35.81	30.02	30.44	25.37	44.19	51.33	26.30	22.36	"
31.11	26.76	42.12	31.11	26.76	42.12	57.37	39.10	3.52	"

Data for the system ethyl ether, succinic acid nitrile and water are given by Schreinemakers, 1898.

Data for the extraction of formic acid from water by ether are given by Dakin, Janney and Wakemann, 1913.

ETHYL FORMATE $HCOOC_2H_5$.

100 grams water dissolve 10 grams ethyl formate at 22°. (Traube, 1884.)

ETHYL METHYL KETONE $CH_3.CO.C_2H_5$.

SOLUBILITY IN WATER. (Rothmund, 1898.)

By synthetic method, see Note, page 16.

t°.	Gms Ketone per 100 Gms Aq. Layer.	Gms Ketone per 100 Gms Ketone Layer	t°.	Gms Ketone per 100 Gms. Aq Layer	Gms Ketone per 100 Gms. Ketone Layer.
−10	34.5	89.7	90	16.1	84.8
+10	26.1	90	110	17.7	80
30	21.9	89.9	130	21.8	71.9
50	17.5	89	140	26	64
70	16.2	85.7	151.8 (crit. temp.)	44.2	

The accuracy of Rothmund's data is questioned by Marshall (1906) and the following new determinations given.

t°.	64.7°.	65.5°.	73.6°.	91.0°.	15°.	73.6°.
Wt. % Ketone in Mixture	18.15	18.08	18	18.08	88.2	85.05

Data for the reciprocal solubility of ethyl methyl ketone and water, containing 1.5% ethyl alcohol, are given by Bruni (1899, 1900). This system is of interest particularly on account of having both an upper and a lower critical point.

Freezing-point data for mixtures of ethylmethyl ketone and water are given by Timmermans (1911) and by Bruni, 1899, 1900.

DIETHYL KETONE (Propione) $(C_2H_5)_2CO$.

SOLUBILITY IN WATER. (Rothmund, 1898.)

The determinations were made by Synthetic Method, see p. 16. The critical temperature could not be reached and high accuracy is not claimed for the results.

t°.	Gms. Diethyl Ketone per 100 Gms. Aq. Layer.	Ketone Layer.	t°.	Gms. Diethyl Ketone per 100 Gms. Aq. Layer.	Ketone Layer.
20	4.60	...	100	3.68	93.10
40	3.43	97.42	120	4.05	90.18
60	3.08	96.18	140	4.76	87.01
80	3.20	94.92	160	6.10	83.33

ETHYL PROPIONATE $C_2H_5COOC_2H_5$.

SOLUBILITY IN WATER AND IN AQUEOUS ETHYL ALCOHOL MIXTURES.
(Pfeiffer, 1892; Bancroft, 1895)

cc. Alcohol in Mixture.	cc. H_2O to Cause Separation of a Second Phase in Mixtures of the Given Amounts of Alcohol and 3 cc. Portions of Ethyl Propionate.
3	2.32
6	6.87
9	12.35
12	19.17
15	27.12
18	36.84
21	50.42
24	∞

100 grams H_2O dissolve 1.7 grams ethyl propionate at 22°. (Traube, 1884.)

DIETHYL Diacetyl **TARTRATE** $(CHOCOCH_3)_2(COOC_2H_5)_2$.

Freezing-point lowering data (solubility, see footnote, p. 1) for mixtures of diethyl diacetyl tartrate and each of the following compounds are given by Scheuer (1910); *m* nitrotoluene, ethylene bromide, phenol and naphthalene. Results for diethyl diacetyl tartrate and naphthalene are also given by Palazzo and Batelli (1883).

ETHYL VALERATE $C_4H_9COOC_2H_5$.

ETHYL (Iso) **VALERATE** $(CH_3)_2.CH.CH_2COOC_2H_5$.

SOLUBILITY OF EACH IN WATER AND IN AQUEOUS ALCOHOL MIXTURES AT 20°.
(Pfeiffer, 1892; Bancroft, 1895.)

100 cc. water dissolve 0.3 cc. ethyl valerate at 25°.
100 cc. water dissolve 0.2 cc. ethyl iso valerate at 20°.
100 cc. ethyl iso valerate dissolve 0.4+ cc. water at 20°.

Mixtures of Ethyl Alcohol, Ethyl Valerate and Water. cc. Alcohol.*	cc. H_2O.†	cc. Alcohol.*	cc. H_2O.†	Mixtures of Ethyl Alcohol, Ethyl Iso Valerate and Water. Per 5 cc. Ethyl Alcohol. cc. H_2O.	cc. Ethyl Iso Valerate.
3	1.42	39	53.13		
9	7.18	45	63.60	10	0.15
15	14.13	57	90.53	8	0.23
21	22.40	72	131.0	6	0.46
27	31.62	81	180.0	5	0.72
33	41.62			4	1.23

* cc. Alcohol in mixture.
† cc. H_2O added to cause the separation of a second phase in mixtures of the given amounts of alcohol and 3 cc. portions of ethyl valerate.

ETHYLENE C_2H_4. SOLUBILITY IN WATER AND IN ALCOHOL.

(Bunsen and Carius; Winkler, 1906.)

t°.	β.	q.
0	0.226	0.0281
5	0.191	0.0237
10	0.162	0.0200
15	0.139	0.0171
20	0.122	0.0150
25	0.108	0.0131
30	0.098	0.0118

Solubility in Alcohol.

t°.	Vols. C_2H_4 per 100 Vols. Alcohol.
0	359.5
4	337.5
10	308.6
15	288.2
20	271.3

For β and q see Ethane, p. 285.

SOLUBILITY OF ETHYLENE IN AQUEOUS SOLUTIONS OF ALKALI HYDROXIDES, ETC., AT 15°. (Billitzer, 1902.)

Results in terms of the Ostwald Solubility Expression l. See p. 227.

Aqueous Solution of:	Solubility l_{15} in Aq. Solution of Normality:				
	0.1.	0.25.	0.5.	0.75.	1.0.
KOH	0.154	0.144	0.130	0.118	0.1056
NaOH	0.153	0.144	0.128	0.114	0.101
NH_4OH	...	0.157	0.156	0.155	0.154
½ Na_2SO_4	0.1525	0.1425	0.127	0.109	0.093
In H_2O alone	0.1593	...	...	...	...

SOLUBILITY OF ETHYLENE IN METHYL ALCOHOL AND IN ACETONE. (Levi, 1901.)

Results in terms of the Ostwald Solubility Expression l. See p. 227.

t°.	In Methyl Alcohol.	In Acetone.	t°.	In Methyl Alcohol.	In Acetone.
0	3.3924	4.0652	30	1.8585	1.8680
10	2.8831	3.3580	40	1.3432	1.0852
20	2.3718	2.6278	50	0.8259	0.2772
25	2.1154	2.2500	60	0.3506	...

The formulas from which the above figures were calculated are:

In Methyl Alcohol, $l = 3.3924 - 0.05083\,t - 0.00001\,t^2$.

In Acetone, $l = 4.0652 - 0.06946\,t - 0.000126\,t^2$.

SOLUBILITY OF ETHYLENE IN SEVERAL SOLVENTS. (McDaniel, 1911.)

Solvent.	t°.	Abs. Coef. A.	Bunsen Coef. β.	Solvent.	t°.	Abs. Coef. A.	Bunsen Coef. β.
Benzene	22	3 010	2 786	Heptane	22 4	3 463	3.207
"	35	2.655	2 353	"	35	3 186	2.824
"	50	2.482	2 100	"	39	3 110	2.722
Hexane	22	3.038	2.8141	Acetone	20	2.571	2.290
"	35	2 826	2.505	"	35	2 308	2 046
"	45	2.586	2.219	Limonene	22	no constant equilibrium	

Abs. Coef. A = vol. of ethylene absorbed by unit vol. of solvent at temp. stated.
For definition of Bunsen Coef. β, see carbon dioxide, p. 227.
The Coef. of Abs. β of ethylene in Russian petroleum is 0.164 at 10° and 0.142 at 20°. (Gniewosz and Walfisz, 1887.)

Freezing-point data (solubility, see footnote, p. 1) for mixtures of ethylene and methyl ether are given by Baume and Germann, 1911, 1914.

ETHYLENE BROMIDE $C_2H_4Br_2$.

F.-PT. DATA FOR MIXTURES OF ETHYLENE BROMIDE AND OTHER COMPOUNDS.

Ethylene Bromide + Naphthalene	(Baud, 1912; Dahms, 1895.)
" " + β Naphthol	(Bruni, 1898.)
" " + " + Picric Acid	(Bruni, 1898.)
" " + Paraldehyde	(Paterno and Ampola, 1897.)
" " + Phenol	(Dahms, 1895; Paterno and Ampola, 1897.)
" " + Toluene	(Baud, 1912.)
" " + Bromotoluene	(Paterno and Ampola, 1897.)
" " + p Xylene	" "

ETHYLENE CYANIDE $C_2H_4(CN)_2$.

DISTRIBUTION BETWEEN WATER AND CHLOROFORM. (Hantzsch and Vagt, 1901.)

t°.	Gm. Mols. $C_2H_4(CN)_2$ per Liter. Aq. Layer, c_1.	$CHCl_3$ Layer, c_2.	Ratio, $\frac{c_1}{c_2}$.
0	0.0786	0.0464	1.69
10	0.0787	0.0463	1 70
20	0.0791	0.0459	1.72

Additional data for the influence of KOH, KCl and HCl on the above distribution are also given.

DiETHYLENE ETHER $(CH_2OCH_2)_2$.

Freezing-point data (solubility, see footnote, p. 1) are given for mixtures of diethylene ether and water, by Unkovskaja, 1913.

Tetraphenyl **ETHYLENE** $(C_6H_5)_2C{:}C(C_6H_5)_2$.

Freezing-point data for tetraphenyl ethylene + silicotetraphenyl are given by Pascal and Normand (1913).

β **EUCAINE** $C_{15}H_{21}NO_2$ and Salts.

100 cc. H_2O dissolve 0.296 gm. anhydrous β eucaine at 20°. } (Zalai, 1910)
100 cc. oil of sesame dissolve 3.49 gms. anhydrous β eucaine at 20°. }

100 cc. aniline oil	dissolve 66.6 gms. anhydrous β eucaine at 20°.			(Squire and Caines, 1905.)
100 cc. H_2O	dissolve	2.5 gms.	β eucaine hydrochloride at 15–20°	
100 cc. 90% alcohol	"	9	" " " "	
100 cc. H_2O	"	25	" " lactate "	
100 cc. 90% alcohol	"	12.5	" " " "	
100 cc. $CHCl_3$	"	20	" " " "	

EUROPIUM Bromonitrobenzene **SULFONATE** $Eu[C_6H_3Br(1)NO_2(4)SO_3(2)]_3 \cdot 10H_2O$.

100 gms. sat. solution in water contain 6.31 gms. anhydrous salt at 25°. (Katz and James, 1913.)

FATS.

SOLUBILITY OF THE FATTY ACIDS OBTAINED FROM SEVERAL SOURCES IN ALCOHOL AND IN BENZENE. (Dubois and Pade, 1885.)

Crude Fatty Acid of:	Gms Fat per 100 Gms. Abs Alcohol at: 0°	10°.	26°.	Gms Fats per 100 Gms. Benzene at 12°.
Mutton	2.48	5.02	67 96	14 70
Beef	2.51	6.05	82.23	15 89
Veal	5	13 78	137.10	26 08
Pork	5 63	11 23	118.98	27.30
Butter	10 61	24.81	158.2	69 61
Margarine	2 37	4 94	47.06	13.53

MISCIBILITY OF FATS AND 90 VOL. PER CENT ALCOHOL AT 37°. (Vandevelde, 1911.)

Mixtures of fats and alcohol in various proportions were shaken twice daily for 8 days and the volume of each layer, as well as its composition, determined.

Mixture.	Composition of Mixture. cc. Alcohol	cc. Fat	Volume after Agitation. cc. Alcohol	cc. Fat	Gms. Fat per 100 Gms. Alcohol Layer	Gms. Alcohol per 100 Gms. Fat Layer.
Alcohol + Cocaline	25	5	25 4	4 6	4.9	19.4
" "	20	10	19.2	10 8	5.6	16.2
" "	15	15	13	17	7 2	13.5
" "	10	20	6.7	23 3	9.1	12.2
" "	5	25	1.1	28 9	13	11.4
Alcohol + Butter Fat	25	5	25.1	4 9	3.5	17.4
" "	20	10	19.2	10 8	3.5	14.1
" "	15	15	13	17	4	14.1
" "	10	20	7.1	22.9	5.7	11.4
" "	5	25	2	28	14.1	9.5
Alcohol + Olive Oil	25	5	24.7	5.3	2.3	11.2
" "	20	10	19.2	10.8	2.4	8.7
" "	15	15	13	17	2.4	8.7
" "	10	20	7.5	22.5	2.5	8.8
" "	5	25	2.2	27.8	7	7.6

For other data on the solubility of fats see Ewers (1910) and Louise (1911).

FLUORENE (Diphenylenemethane) $C_6H_4.CH_2.C_6H_4$.

Freezing-point data (solubility, see footnote, p. 1) are given by Kremann (1911) for mixtures of fluorene and each of the following compounds: *o*, *m* and *p* dintrobenzene, 1.3.5, trinitrobenzene, dinitrophenol, dinitrotoluene, trinitrotoluene and picric acid.

FLUORESCEIN $C_{20}H_{12}O_5$.

100 gms. H_2O dissolve 0.005 gm. fluorescein at 20–25° (Dehn, 1917.)
100 gms. pyridine dissolve 13.29 gms. fluorescein at 20–25° "
100 gms. aq. 50% pyridine dissolve 37.22 gms. fluorescein at 20–25° "

FORMALDEHYDE, Solid Polymers $(CH_2O)_n$.

SOLUBILITY OF THE SIX WELL-DEFINED SOLID POLYMERS OF FORMALDEHYDE IN WATER. (Auerbach and Barschall, 1908)

Name.	Formula.	m. pt	Gms. per 100 cc. Sat. Solution in Water.
Paraformaldehyde	$(CH_2O)_n + xH_2O$	150–160	20–30 gms. at 18°
α Polyoxymethylene	$(CH_2O)_n$	163–8	11 gms. at 18–25°
β Polyoxymethylene	$(CH_2O)_n$	163–8	3.3 gms. at 18°, about 4 at 25°
γ Polyoxymethylene	$(CH_2O)_n$	163–5	less than 0.1 at 18°, 0.1 gm. at 25°
δ Polyoxymethylene	$(CH_2O)_n$	169–70	practically insoluble
α Trioxymethylene	$C_3H_6O_3$	63–4	17.2 at 18°, 21.1 at 25°

All are insoluble in alcohol and ether except trioxymethylene.

SOLUBILITY OF TRIOXYMETHYLENE IN AQ. SODIUM SULFITE SOLUTIONS AT 15°. (Lumière and Seyewetz, 1902)

Gms. Na_2SO_3 per 100 cc. H_2O	5	10	20	25	28 (sat.)
Gms. $C_3H_6O_3$ per 100 cc. sat. sol.	22	24	26	27	27

Data are also given for the solubility of various mixtures of trioxymethylene and sodium sulfite in water at 15°.

The distribution coefficient of formaldehyde between water and ether is 8.5 at 0° and 9.23 at 20°. (Hantzsch and Vagt, 1901.)

FORMAMIDE $HCONH_2$.

SOLUBILITY IN WATER, DETERMINED BY THE FREEZING-POINT METHOD. (English and Turner, 1915)

t° of Solidif.	Gms. $HCONH_2$ per 100 Gms. H_2O.	Solid Phase.	t° of Solidif.	Gms $HCONH_2$ per 100 Gms H_2O.	Solid Phase.	t° of Solidif	Gms. $HCONH_2$ per 100 Gms H_2O.	Solid Phase.
−0	0	Ice	−31 1	116 4	Ice	−37.6	267	$HCONH_2$
−2.7	9.93	"	−42 5	169	"	−29 4	369 8	"
−5.7	17.87	"	−45 4	187 8	$HCONH_2.H_2O$	−21 9	540 3	"
−11	35 45	"	−40 4	218 3	"	−14 5	836.8	"
−23 6	81.93	"	−40	241.4	"	− 6 4	1780	"

Similar data are also given for formamide + formic acid and formamide + propionic acid.

o and *p* Chloro**FORMANILIDES** $Cl.C_6H_4NH.CHO$.

Freezing-point lowering data for mixtures of *o* and *p* chloroformanilide are given by King and Orton, 1911.

FORMIC ACID HCOOH.

SOLUBILITY IN WATER, DETERMINED BY FREEZING-POINT METHOD. (Faucon, 1910.)

t° of Solidif.	Gms HCOOH per 100 Gms. Mixture.	t° of Solidif.	Gms HCOOH per 100 Gms. Mixture.	t° of Solidif.	Gms. HCOOH per 100 Gms. Mixture.
0	0	−30	53	−40	74.2
−5	12.5	−35	57.6	−30	79
−10	23	−40	62.5	−20	84.2
−15	32	−45	66.5	−10	89.4
−20	39.2	−49 Eutec.	70	0	95
−25	46.5	−45	71.7	+8.51	100

Similar data for mixtures of 97.4% formic acid and water are given by Kremann, 1907.

DISTRIBUTION OF FORMIC ACID BETWEEN WATER AND BENZENE AT 13–15°.
(v. Georgievics, 1913.)

A small separatory funnel was used and the acid in each layer titrated with 0.1 *n* NaOH, using phenolphthaleine as indicator.

Gms. HCOOH Found per: 25 cc. H_2O Layer.	150 cc. C_6H_6 Layer.	Gms. HCOOH Found per: 25 cc. H_2O Layer.	150 cc. C_6H_6 Layer.
1.016	0.016	2.365	0.035
1.539	0.031	3.826	0.062
1.800	0.024	5.874	0.114
2.112	0.031	7.836	0.138

The distribution ratio of formic acid between water and benzene was found by King and Narracott (1909) to be 1 to 0.0242 at room temp.

Freezing-point lowering data (solubility, see footnote, p. 1) are given for mixtures of formic acid and dimethylpyrone by Kendall, 1914.

FUMARIC ACID COOH.CH:CH.COOH.

MALEIC ACID COOH.CH:CH.COOH. (See also p. 398.)

SOLUBILITY IN WATER. (Vaubel, 1899.)

100 gms. water dissolve 0.672 gm. fumaric acid at 165°.
100 gms. water dissolve 50 grams maleic acid at 100°.

Data for the distribution of fumaric acid between water and ether at 25° are given by Chandler, 1908.

FURFUROL C_4H_3OCHO.

SOLUBILITY IN WATER. (Rothmund, 1898.)

Determinations by Synthetic Method, for which see p. 16.

t°.	Gms C_4H_3OCHO per 100 Gms. Aq. Layer.	Furfurol Layer.	t°.	Gms. C_4H_3OCHO per 100 Gms. Aq. Layer.	Furfurol Layer.
40	8.2	93.7	100	18.9	83.5
50	8.6	93	110	24	78.5
60	9.2	92	115	28	74.6
70	10.8	90.7	120	34.4	68.1
80	13	89	122.7 (crit. t.)	51	
90	15.5	86.6			

GADOLINIUM CobaltiCYANIDE $Gd_2(CoC_6N_6)_2.9H_2O$.

1000 gms. aq. 10% hydrochloric acid dissolve 1.86 gms. of the salt at 25°. (James and Willard, 1916.)

GADOLINIUM GLYCOLATE $Gd_2(C_2H_3O_3)_3.2H_2O$.

1000 cc. H_2O dissolve 14.147 gms. of the salt at 20°. (Jantsch and Grünkraut, 1912–13.)

GADOLINIUM Magnesium NITRATE, etc.

SOLUBILITY OF DOUBLE NITRATES OF GADOLINIUM AND OTHER METALS IN CONC. NITRIC ACID OF d_{16} = 1.325 (= 51.59 GM. HNO_3 PER 100 CC.) AT 16°. (Jantsch, 1912.)

Salt.	Formula.	Gms. Hydrated Salt per Liter Sat. Solution.
Gadolinium Magnesium Nitrate	$[Gd(NO_3)_6]_2Mg_3.24H_2O$	352.3
" Nickel "	" Ni_3 "	400.8
" Cobalt "	" Co_3 "	451.4
" Zinc "	" Zn_3 "	472.7

GADOLINIUM OXALATE $Gd_2(C_2O_4)_3.10H_2O$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°. (Wirth, 1912.)

Normality of Aq. H_2SO_4.	Gms per 100 Gms. Sat Sol. Gd_2O_3.	$Gd_2(C_2O_4)_3$.	Solid Phase.
2.16	0.1883	0.3005	$Gd_2(C_2O_4)_3.10H_2O$
3.11	0.3010	0.4803	"
4.32	0.4359	0.6956	"
6.175	0.707	1.128	"

SOLUBILITY OF GADOLINIUM OXALATE IN AQUEOUS 20% SOLUTIONS OF METHYLAMINE OXALATE, ETHYLAMINE OXALATE AND TRIETHYLAMINE OXALATE.
(Grant and James, 1917.)

Solvent.	Gms. $Gd_2(C_2O_4)_3$ per 100 cc. Solvent.
Aq. 20% Methylamine Oxalate	0.069
" Ethylamine "	0.360
" Triethylamine "	0.883

GADOLINIUM Dimethyl **PHOSPHATE** $Gd_2[(CH_3)_2PO_4]_6$.

100 gms. H_2O dissolve 23 gms. $Gd_2[(CH_3)_2PO_4]_6$ at 25° and 6.7 gms. at 95°. (Morgan and James, 1914.)

GADOLINIUM SULFATE $Gd_2(SO_4)_3.8H_2O$.

SOLUBILITY IN WATER. (Benedicks, 1900.)

t°.	Gms. $Gd_2(SO_4)_3$ per 100 Gms H_2O.	Solid Phase.
0	3.98	$Gd_2(SO_4)_3.8H_2O$
10	3.3	"
14	2.8	"
25	2.4	"
34.4	2.26	"

SOLUBILITY OF GADOLINIUM SULFATE IN AQUEOUS SOLUTIONS OF:

Sodium Sulfate at 25°. (Bissell and James, 1916)

Gms. per 100 Gms H_2O. Na_2SO_4.	$Gd_2(SO_4)_3$	Solid Phase.
0	2 15	$Gd_2(SO_4)_3.8H_2O$
0.43	2.06	"
0.47	0 76	$Gd_2(SO_4)_3.Na_2SO_4.2H_2O$
1 26	0 17	"
3 01	0 07	"
7.46	0 05	"
27 40	0 05	"

Sulfuric Acid at 25°. (Wirth, 1912.)

Normality of H_2SO_4.	Gms per 100 Gms Sat Sol Gd_2O_3	= $Gd_2(SO_4)_3$.	Solid Phase.
0	1.793	2 981	$Gd_2(SO_4)_3.8H_2O$
0 1	1 98	3.291	"
0 505	2 365	3 931	"
1 1	2 29	3 807	"
2 16	1 789	2 974	"
6 175	0 528	0 8777	"
12 6	0.0521	0 0867	"

GADOLINIUM SULFONATES.

SOLUBILITY IN WATER.

Salt.	Formula.	t°.	Gms. Anhydrous Salt per 100 Gms. H_2O.	Authority.
Gadolinium *m* Nitrobenzene Sulfonate	$Gd[C_6H_4(NO_2)SO_3]_3.7H_2O$	15	43 8	(Holmberg, 1907.)
Gadolinium Bromonitrobenzene Sulfonate	$Gd[C_6H_3Br(NO_2)SO_3(1.4.2)]_3.10H_2O$	25	6.31	(Katz and James, 1913.)

GALACTOSE $C_6H_{12}O_6$. See also Sugars, pages 695–7.

100 gms. saturated solution in pyridine contain 5.45 gms. $C_6H_{12}O_6$ at 26°, density of solution = 1.0065. (Holty, 1905.)

100 gms. H_2O dissolve 68.3 gms. galactose at 20–25°. (Dehn, 917.)

100 gms. aq. 50% pyridine dissolve 6.83 gms. galactose at 20–25°. "

GALLIC ACID 3.4.5, $(OH)_3C_6H_2COOH.H_2O$.

SOLUBILITY IN AQUEOUS ETHYL ALCOHOL AT 25°.
(Seidell, 1910.)

Wt. Per Cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_6H_2(OH)_3COOH.H_2O$ per 100 Gms. Sat. Sol.	Wt. Per Cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_6H_2(OH)_3COOH.H_2O$ per 100 Gms. Sat. Sol.
0	1.002	1.15	60	0.957	16
10	0.992	2	70	0.946	18
20	0.983	4.2	80	0.933	19.9
30	0.977	7.5	90	0.919	21.2
40	0.972	10.6	95	0.911	21.6
50	0.965	13.4	100	0.902	22.2

100 gms. H_2O dissolve 0.95 gm. gallic acid at 15°. (Greenish and Smith, 1903.)

100 gms. H_2O dissolve 33. 3 gms. gallic acid at 100°. (U. S. P. VIII)

SOLUBILITY OF GALLIC ACID IN ORGANIC SOLVENTS AT 25°.
(Seidell, 1910.)

Solvent.	Density of Solvent.	d_{25} of Sat. Solution.	Gms. $C_6H_2(OH)_3COOH.H_2O$ per 100 Gms. Sat. Sol.
Acetone	$d_{15} = 0.797$	0.941	25.99
Amylalcohol (iso)	$d_{20} = 0.817$	0.834	5.39
Amylacetate	$d_{20} = 0.875$	0.878	2.72
Benzene	$d_{25} = 0.873$	0.875	0.022
Carbon Disulfide	$d_{25} = 1.258$	1.262	0.042
Ether (abs.)	$d_{20} = 0.711$	0.718	1.370
Ethylacetate	$d_{25} = 0.892$	0.911	3.610

The amount of gallic acid dissolved by carbon tetrachloride, chloroform and toluene was too small for estimation.

100 gms. glycerol dissolve 8.3 gms. $C_6H_2(OH)_3COOH.H_2O$ at 25°. (U. S. P. VIII.)

100 gms. 95% formic acid dissolve 0.56 gm. gallic acid at 19.4°. (Aschan, 1913.)

GERMANIUM DIOXIDE GeO_2.

100 gms. H_2O dissolve 0.405 gm. GeO_2 at 20°, and 1.07 gms. at 100°. (Winkler, 1887.)

GERMANIUM (Mono) **SULFIDE** GeS

GERMANIUM (Di) **SULFIDE** GeS_2.

100 gms. H_2O dissolve 0.24 gm. GeS

100 gms. H_2O dissolve 0.45 gm. GeS_2. (Winkler, 1887.)

GLASS.

For data on the solubility of glass in water and other solvents, see:
(Cowper, 1882; Emmerling, 1869; Bohling, 1884; Kreusler and Herzhold, 1884; Kohlrausch, 1891; Forster, 1892; Mylius and Forster, 1889; 1892; Wartha, 1885; Nicolardot, 1916.)

GLOBULIN (Serum).

SOLUBILITY IN AQUEOUS MAGNESIUM SULFATE SOLUTIONS.
(Galeotti, 1906, Scaffidi, 1907.)

The precipitated globulin (from oxblood) was not dried, but pressed between filter paper, and an excess introduced into each $MgSO_4$ solution. After constant agitation for 12 hours, the saturated solution was filtered, weighed and evaporated to constant weight, the coagulated globulin then washed to disappearance of SO_4 and dried and weighed.

Results for 10°. Gms. per 100 Gms. Sat. Sol.		Results for 25°. Gms. per 100 Gms. Sat. Sol.		Results for 40°. Gms. per 100 Gms. Sat. Sol.		Results for 55°. Gms. per 100 Gms. Sat. Sol.		Results for 70°. Gms. per 100 Gms. Sat. Sol.	
$MgSO_4$.	Globulin.	$MgSO_4$.	Globulin.	$MgSO_4$.	Globulin.	$MgSO_4$.	Globulin.	$MgSO_4$.	Globulin.
0.06	0.07	0.06	0.07	0.06	0.42	0.40	1.14	0.71	0.34
0.18	0.34	0.21	0.61	0.31	1.42	0.88	2.14	2.52	0.55
0.65	1.63	0.63	2.20	0.61	5.39	1.60	3.34	4.74	1.14
2.11	3.35	2.28	5.56	1.92	8.31	5.64	5.06	6.83	1.17
4.32	4.42	3.35	6.07	5.40	8.63	10.81	3.10	9.22	1.76
13.63	2.60	16	4.03	14.72	3	13.84	2.11	13.29	1
20.86	0.37	21.30	0.95	18.47	1.02	17.90	0.69	15.38	0.37
24.18	0.18	25.47	0.03	27.03	0.01			17.67	0.07

The coagulation curve and freezing-point curve are also given.

GLUCOSE *d* $C_6H_{12}O_6.H_2O$. See also Sugars, pages 695–7.

100 gms. H_2O	dissolve 82	gms. glucose at	20–25°.	(Dehn, 1917.)
100 gms. pyridine	" 7.62	" "	"	"
100 gms. aq. 50% pyridine	" 49.17	" "	"	"
100 gms. trichlor ethylene	" 0.006	" "	15°	(Wester and Bruins, 1914.)

GLUTAMINIC ACID $C_3H_5NH_2(COOH)_2$.

Data for the solubility of glutaminic acid in aq. salt solutions are given by Würgler (1914) and Pfeiffer and Würgler (1916).

GLUTAMINIC ACID HYDROCHLORIDE $C_3H_5NH_2(COOH)_2.HCl$.

SOLUBILITY IN WATER. (Stoltzenberg, 1912)

(The following results were taken from the diagram given by the author.)

t°.	Gms. Glutaminic Acid. HCl per 100 cc. Sat. Sol.	t°.	Gms. Glutaminic Acid. HCl per 100 cc. Sat. Sol.
0	31.5	60	57
10	34.5	70	62
20	38	80	67.5
30	42.5	90	74
40	47	100	81
50	52	20	1.4 (sol. sat. with HCl)

GLUTARIC ACID (Pyrotartaric) $(CH_2)_3(COOH)_2$.

SOLUBILITY IN WATER. (Lamouroux, 1899)

t°.	0°.	15°.	20°.	35°.	50°.	65°.
Gms. $(CH_2)_3(COOH)_2$ per 100 cc. solution	42.9	58.7	63.9	79.7	95.7	111.8

100 gms. 95% formic acid dissolve 55.62 gms. glutaric acid at 18.6°. (Aschan, 1913)

Data for the distribution of glutaric acid between water and ether at 25° are given by Chandler, 1908.

F. pt. data for glutaric acid + sulfuric acid. (Kendall and Carpenter, 1914.)

GLYCINE (Glycocoll) $CH_2.NH_2.COOH$.

100 gms. H_2O dissolve 51 gms. $CH_2.NH_2.COOH$ at 20–25°. (Dehn, 1917.)

100 gms. pyridine dissolve 0.61 gm. $CH_2.NH_2.COOH$ at 20–25°. "

100 gms. aq. 50% pyridine dissolve 0.74 gm. $CH_2.NH_2.COOH$ at 20–25°. "

SOLUBILITY OF GLYCINE IN WATER AND IN AQ. SALT SOLUTIONS AT 20°.

(Pfeiffer and Würgler, 1915, 1916.)

Salt.	Mols. Salt per Liter.	Gms Glycine per 10 cc. Sat Sol.	Salt.	Mols Salt per Liter.	Gms. Glycine per 10 cc. Sat. Sol.
Water only		1.962	LiCl	0.96	4.188
$BaCl_2$	0.5	2.375	LiBr	0.97	4.245
$BaBr_2$	0.5	2.954	$SrCl_2$	0.25	2.129
$SrCl_2$	0.5	2.362	"	0.50	2.331
$SrBr_2$	0.49	2.440	"	1	2.605
$CaCl_2$	0.57	4.848	"	2	3.301
$CaBr_2$	0.51	4 994			

10 cc. sat. aq. solution contains 1.8 gms. glycine + 2.7 gms. KCl at 20° when both are present in the solid phase. (Pfeiffer and Modelski, 1912.)

GLYCOLIC ACID $CH_2OH.COOH$.

SOLUBILITY IN WATER. (Emich, 1884)

t°.	20°.	60°.	80°.	100°.
Gms. $CH_2OH(COOH)$ per 100 gms. H_2O	0.033	0.102	0.235	0.850

Phenyl**GLYCOLIC ACID** dextro and racemic. $CH.C_6H_5.OH.COOH$.

SOLUBILITY OF DEXTRO AND OF RACEMIC PHENYL GLYCOLIC ACID IN CHLOROFORM.

(Holleman, 1898)

t°.	Gms. Detro Acid per 100 Gms. $CHCl_3$.	t°.	Gms Racemic Acid per 100 Gms $CHCl_3$.
15	0.952	15	0.877
25	1.328	25	1.07
35	1.950	35	1 60

GLYCYRRHIZIC ACID.

100 gms. sat. solution in H_2O contain 0.575 gm. glycyerrhizic acid at 15°. (Capin, '12.)

100 gms. sat. solution in H_2O contain 0.152 gm. Am. glycyrrhizate at 0° and 0.225 gm. at 15°. (Capin, 1912.)

Phenyl**GLYOXAL** Phenyl hydrazone $C_6H_5.CO.CH.N.NH.C_6H_5$.

One liter C_6H_6 dissolves 52.6 gms. of the *A* form at 5°. (Sidgwick, 1915)

One liter C_6H_6 dissolves 2.9 gms. of the *B* form at 5°. "

GOLD Au.

SOLUBILITY OF GOLD IN POTASSIUM CYANIDE SOLUTIONS. (Maclaurin, 1893.)

Gold disks were placed in Nessler tubes with aqueous KCN solutions.

Per cent KCN.	Gms. Au Dissolved in 24 Hours in Nessler Tubes: Full.	½ Full.	Oxygen. Passed in.	Oxygen + Agitation.
0.1	0.00195	0.00331	...	...
1	0.00162	0.00418	0.00845	0.0187
5	0.0032	0.0046	0.01355	0.0472
20	0.0012	0.00305	0.0115	0.0314
50	0.00043	0.00026	0.00505	0.0108

The following data for more dilute KCN solutions are given by Christy (1901). Gold strips 2 × ¼ inch were rotated for 24 hrs. in aq. KCN solutions and the loss in weight determined.

Per cent KCN.	Mgs. Au Dissolved.	Per cent KCN.	Mgs. Au Dissolved.	Per cent KCN.	Mgs. Au Dissolved.
0	0.010	0.002	0.44	0.016	74.96
0.0005	0.043–0.07	0.00325	1.77	0.0325	150.54
0.001	0.10–0.23	0.004	4.29	0.065	168.12
0.0016	0.16	0.008	48.43		

Data are also given for 48 hour periods and for solutions containing O_2.

One liter of conc. HNO_3 dissolved 0.66 gm. Au on boiling for two hours. (Dewey, '10.)

Data for the rate and limit of solubility of Au in conc. HCl solutions of iron alum and of cupric chloride are given by McCaughey, 1909.

GOLD CHLORIDE (Auric) $AuCl_3$.

100 gms. H_2O dissolve 68 gms. $AuCl_3$.

When 1 gm. of gold as chloride is dissolved in aq. HCl of different strengths and the solutions shaken with 100 cc. portions of ether, the following percentages of the gold enter the ethereal layer. With 20% HCl, 95%; 10% HCl, 98%; 5% HCl, 98%; 1% HCl, 84% and 0.18% HCl, 40.3% of the gold.

Distribution results, indicating considerable variation in the constitution of the dissolved substance in the two layers, are also given. (Mylius, 1911.)

GOLD PHOSPHORUS TRI CHLORIDE (Aurous) $AuClPCl_3$.

100 gms. PCl_3 dissolve 1 gram at 15°, and about 12.5 grams at 120°. (Lindet — Compt. rend. 101, 1492, '85.)

GOLD ALKALI DOUBLE CHLORIDES.

SOLUBILITY OF SODIUM GOLD CHLORIDE, LITHIUM GOLD CHLORIDE, POTASSIUM GOLD CHLORIDE, RUBIDIUM GOLD CHLORIDE, AND CAESIUM GOLD CHLORIDE IN WATER.

(Rosenbladt — Ber. 19, 2537, '86.)

t°.	Grams Anhydrous Salt per 100 Grams Solution. $NaAuCl_4$.	$LiAuCl_4$.	$KAuCl_4$.	$RbAuCl_4$.	$CsAuCl_4$.
10	58.2	53.1	27.7	4.6	0.5
20	60.2	57.7	38.2	9.0	0.8
30	64.0	62.5	48.7	13.4	1.7
40	69.4	67.3	59.2	17.7	3.2
50	77.5	72.0	70.0	22.2	5.4
60	90.0	76.4	80.2	26.6	8.2
70	...	81.0	...	31.0	12.0
80	...	85.7	...	35.3	16.3
90	...	...	...	39.7	21.7
100	...	...	...	44.2	27.5

100 gms. glycerol (d_{15} = 1.256) dissolve 0.21 gm. $AuK(CN)_2.5H_2O$ at 15–16°. (Ossendowski, 1907.)

GUAIACOL $C_6H_4(OH)OCH_3o$.
GUAIACOL CARBONATE $[C_6H_4(OCH_3)O]_2CO$.

SOLUBILITY IN WATER, ALCOHOL, ETC. (U. S. P. VIII.)

Solvent.	t°.	Gms. per 100 Gms. Solvent.	
		Guaiacol.	Guaiacol Carbonate.
Water	25	1.89	...
Alcohol	25	...	2.08
Chloroform	25	...	66.6
Ether	25	...	7.69
Glycerol	25	100	...

The coefficient of distribution of guaiacol carbonate between olive oil and water at 25° is given as $\frac{S_{oil}}{S_w} = 3.7$ by Boëseken and Waterman, 1911, 1912.

Freezing-point lowering data (solubility, see footnote, p. 1) are given for mixtures of guaiacol and α naphthylamine by Pushin and Mazarovic, 1914; for mixtures of guaiacol and picric acid by Philip and Smith, 1905; and for mixtures of guaiacol and salol by Bellucci, 1912, 1913.

α Tri Phenyl**GUANIDINE** $C_6H_5N:C(NHC_6H_5)_2$.

SOLUBILITY IN MIXTURES OF ALCOHOL AND WATER AT 25°. (Holleman and Antusch, '94.)

Vol. % Alcohol.	Gms. $C_6H_5N\,C(NHC_6H_5)_2$ per 100 Gms. Solvent.	Density of Solutions.	Vol % Alcohol.	Gms. $C_6H_5N:C(NHC_6H_5)_2$ per 100 Gms. Solvent.	Density of Solutions.
100	6.23	0.8021	80	1.06	0.8572
95	3.75	0.8158	75	0.67	0.8704
90	2.38	0.8309	70	0.48	0.8828
85	1.58	0.8433	60	0.22	0.9048

See remarks under α Acetnaphthalide, p. 13.

Freezing-point lowering data for mixtures of triphenylguanidine and triphenyl methane and for triphenylguanidine and phthalide are given by Lautz, 1913.

HEMOGLOBIN.

100 gms. H_2O dissolve 15.16 gms. hemoglobin at 20–25°. (Dehn, 1917.)
100 gms. pyridine dissolve 0.15 gm. hemoglobin at 20–25°. "
100 gms. aq. 50% pyridine dissolve 0.77 gms. hemoglobin at 20–25°. "

HELIANTHIN (Methyl Orange, Tropaeolin).

100 cc. H_2O dissolve 0.0055 to 0.0225 gm. helianthin. (Dehn, 1917a.)
100 cc. pyridine dissolve 0.75 gm. helianthin. "
100 cc. 50% aq. pyridine dissolve 62.5 gms. helianthin. "
Results for other solvents and observations on the state of colored compounds in solution are given.

HELIUM He.

SOLUBILITY IN WATER. (von Antropoff, 1909–10.)

t°.	Coef. of Absorption.
0	0.0134
10	0.0100
20	0.0138
30	0.0161
40	0.0191
50	0.0226

The coef. of absorption adopted for the present results is that of Bunsen as modified by Kuenen. The modification consists in substituting unit of mass in place of unit of volume of water, in the formula.

HELIUM He.

SOLUBILITY IN WATER.
(Estreicher — Z. physik. Chem. 31, 184, '99.)

t°.	Cor. Barometic Pressure.	Vol. of Water.	Vol. of He.	q.	Absorption Coefficient. At Bar. Pressure Minus H_2O Vapor Tension.	At 760 mm. Pressure.
0	...	...	...	0.000270	...	0.0150
0.5	764.0	73.584	1.093	...	0.0149	0.0149
5	758.0	73.578	1.062	0.000260	0.0144	0.0146
10	758.0	73.597	1.046	0.000255	0.0142	0.0144
15	757.8	73.641	1.008	0.000246	0.0137	0.0140
20	758.4	73.707	0 996	0.000242	0.0135	0.0139
25	762.3	73.793	0.983	0.000238	0.0133	0.0137
30	764.4	73.897	0.985	0.000238	0.0133	0.0138
35	764.5	74.0167	0.972	0.000234	0.0131	0.0138
40	762.0	74.147	0.957	0.000232	0.0129	0.0139
45	761.7	74.294	0.947	0.000229	0.0127	0.0140
50	760.9	74.461	0 920	0 000223	0.0124	0.0140

For q and also absorption coefficient, see Ethane, p. 285.

HEPTANE n $CH_3(CH_2)_5CH_3$.

F.-pt. lowering data for mixtures of heptane and phenol are given by (Campett and Delgrosso, 1913).

HEPTOIC ACID $CH_3(CH_2)_5COOH$.

100 gms. H_2O dissolve 0.241 gm. heptoic acid at 15°. (Lumsden, 1905.)

HEXAMETHYLENE (Hexahydrobenzene). See Cyclohexane, p. 280.

HEXAMETHYLENE TETRAMINE $(CH_2)_6N_4$.

100 gms. H_2O dissolve 81.32 gms. $(CH_2)_6N_4$ at 12°. (Delepine, 1895.)
100 gms. abs. alcohol dissolve 3.22 gms. $(CH_2)_6N_4$ at 12°. "
100 cc. 90% alcohol dissolve 12.5 gms. $(CH_2)_6N_4$ at 15-20°. (Squire and Caines, 1905.)
100 gms. $CHCl_3$ dissolve 8.09 gms. $(CH_2)_6N_4$ at 12°. (Delepine, 1895.)

HEXANE C_6H_{14}.

SOLUBILITY IN METHYL ALCOHOL.
(Rothmund, 1898)

Determined by synthetic method, see p. 16.

t°.	Gms Hexane per 100 Gms. Alcoholic Layer.	Hexane Layer.	t°.	Gms Hexane per 100 Gms. Alcoholic Layer	Hexane Layer.
10	26.5	96.8	35	43.6	91.2
20	31.6	95.9	40	52.7	85.5
30	38.3	93.7	42.6	(crit. t.) 68.9	

F.-pt. data for hexane + phenol. (Campetti and Delgrosso, 1913.)

HIPPURIC ACID $C_6H_5CO.NH.CH_2COOH$.

SOLUBILITY IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. $C_6H_5CO.NHCH_2COOH$ per 100 Gms Solvent.	Authority.
Water	20-25	0.42	(Dehn, 1917.)
Methyl Alcohol	22	9.80	(Timofeiew, 1894.)
Ethyl Alcohol	22	5.20	"
Propyl Alcohol	23	2.80	"
50% Aqueous Pyridine	20-25	88	(Dehn, 1917.)

SOLUBILITY OF HIPPURIC ACID AT 25° IN AQUEOUS SOLUTIONS OF:

Formic Acid. (Kendall, 1911.) Sodium Hippurate. (Sidgwick, 1910.)

Normality of Aq. HCOOH.	Gms. Hippuric Acid per Liter.	Normality of Aq. HCOOH.	Gms. Hippuric Acid per Liter.	Normality of Aq. Sodium Hippurate.	Gms Hippuric Acid per Liter.
0	3.67	5	4.08	0	6.99(?)
1.25	3.61	10	4.77	1	13.97(?)
2.5	3.72				

HIPPURIC ACID $C_6H_5CONH.CH_2COOH$.

SOLUBILITY IN AQ. POTASSIUM HIPPURATE SOLUTIONS AT 20°.
(Hoitsema — Z. physik. Chem. 27, 317, '98.)

Density of Solutions.	Gram Mols per Liter Sol. $C_9H_9NO_3$.	Gram Mols per Liter Sol. $KC_9H_8NO_3$.	Grams per Liter Solution. $C_9H_9NO_3$.	Grams per Liter Solution. $KC_9H_8NO_3$.	Solid Phase.
1.002	0.0182	0	3.276	0.0	$C_9H_9NO_3$
1.003	0.0163	0.011	2.919	2.39	"
1.008	0 0183	0.071	3.278	15 43	"
1 022	0.0234	0.254	4.191	55.18	"
1.114	0 064	1.36	11.47	295.4	"
1.182	0 131	2 21	23.46	480.1	"
1.192	0.147	2.32	26.32	504.1	$C_9H_9NO_3$+ $C_9H_9NO_3.KC_9H_8NO_3.H_2O$
1.195	0.153	2.40	27.40	521.4	
1.201	0.133	2.50	23.82	543 1	$C_9H_9NO_3.KC_9H_8NO_3.H_2O$
1.239	0.084	3.01	15.04	654 0	"
1.282	0.068	3 57	12.18	775.7	$C_9H_9NO_3.KC_9H_8NO_3.H_2O$ $+KC_9H_8NO_3$
1.282	0 065	3 58	11.60	777.8	
1.276	0.031	3 56	5.55	773.4	$KC_9H_8NO_3$
1.277	0 011	3.55	1.917	771.3	"
1.277	0.00	3.56	...	773.4	"

HOLOCAINE HYDROCHLORIDE.

100 gms. H_2O dissolve 2 gms. holocaine hydrochloride at 15–20°.
(Squire and Caines, 1905.)

HOMATROPINE HYDROBROMIDE $C_{16}H_{21}NO_3.HBr$.

SOLUBILITY IN WATER, ETC.
(U S P VIII)

100 gms. water dissolve 17.5 gms. salt at 25°.
100 gms. alcohol dissolve 3.08 gms. salt at 25°, and 11.5 gms. at 60°.
100 gms. chloroform dissolve 0.16 gm. salt at 25°.

HYDRASTINE $C_{21}H_{21}NO_6$. HYDRASTININE HYDROCHLORIDE $C_{11}H_{11}NO_2.HCl$.

SOLUBILITY IN SEVERAL SOLVENTS.
(U. S. P. VIII, at 18°–22°, Müller, 1903)

Solvent.	Gms. $C_{21}H_{21}NO_6$ per 100 Gms. Solution. At 18°–22°.	At 80°.	Solvent.	Gms. per 100 Gms. Solution at 18°–22° $C_{21}H_{21}NO_6$.	$C_{11}H_{11}NO_2.HCl$.
Water	0.033	0.025	Ether	0.51	0.078 (25°)
Alcohol	0.74 (25°)	5.9 (60°)	Ether+H_2O	0.80	...
Benzene	8.89	...	Chloroform	100+	0.35 (25°)
Ethyl Acetate	4.05	...	CCl_4	0.123	...
Petroleum Ether	0.073				

HYDRAZIDES.

SOLUBILITY OF THE TAUTOMERIC FORMS OF HYDRAZIDES IN BENZENE AT 5°.

Determined by the freezing-point method. See also p. 487. (Sidgwick, 1915.)

Compound.	Formula.		Gms. Compound Dissolved per Liter Benzene.
Phthalylphenylhydrazide	$C_6H_4\langle{CO \atop CO}\rangle N.NH.C_6H_5$	*A* form	5.5
		C form	1.1
Phthalylphenylmethylhydrazide	$C_6H_4\langle{CO \atop CO}\rangle N.N(CH_3)C_6H_5$	*A* form	124

HYDRAZINE $NH_2.NH_2$.

DISTRIBUTION OF HYDRAZINE BETWEEN WATER AND BENZENE.
(Georgievics, 1915.)

Gms NH_2NH_2 per: 25 cc. H_2O Layer.	75 cc. C_6H_6 Layer.	Gms NH_2NH_2 per: 25 cc. H_2O Layer.	75 cc. C_6H_6 Layer.
0.4137	0.027	1.7601	0.0626
0.6676	0.0335	2.3336	0.1101
1.0862	0.0355	4.75	0.137

HYDRAZINE PerCHLORATE $N_2H_4(HClO_4)_2.3H_2O$.

SOLUBILITY IN WATER. (Carlson, 1910.)

t°.	Sp. Gr. Sat. Sol.	Gms. $N_2H_4(HClO_4)_2$ per 100 cc. Sat. Sol.
18	1.264	41.72
35	1.391	66.9

HYDRAZINE MonoNITRATE $N_2H_4.HNO_3$.

SOLUBILITY IN WATER. (Sommer, 1914.)

t°.	Gms. $N_2H_4HNO_3$ per 100 Gms. Sat. Sol.	Water.	t°.	Gms. $N_2H_4HNO_3$ per 100 Gms. Sat. Sol.	Water.
10	63.63	174.9	40.02	85.86	607.2
15	68.47	217.2	45.02	88.06	737.6
20.01	72.70	266.3	50.01	91.18	1034
25.01	76.61	327.5	55.01	93.58	1458
30.01	80.09	402.2	60.02	95.51	2127
35.01	83.06	490.3			

HYDRAZINE SULFATE $N_2H_4.H_2SO_4$.

100 grams water dissolve 3.055 gms. $N_2H_4.H_2SO_4$ at 22°. (Curtius and Jay, 1889.)

Phenyl **HYDRAZINE** and other substituted hydrazines. See page 486.

HYDRIODIC ACID HI.

SOLUBILITY IN WATER, DETERMINED BY FREEZING-POINT METHOD.
(Pickering, 1893a.)

t°.	Gm. HI per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. HI per 100 Gms. Sat. Sol.	Solid Phase.
−10	20.3	Ice	−60	52.6	$HI.4H_2O$
−20	29.3	"	−40	59	"
−30	35.1	"	about −35.5 m. pt.	64	"
−40	39	"	−40	65.5	"
−50	42	"	−49	66.3	" $+HI.3H_2O$
−60	44.4	"	−48 m. pt.	70.3	$HI.3H_2O$
−70	46.2	"	−56	73.5	" $+HI.2H_2O$
−80	47.9	" $+HI.4H_2O$	−52	74	$HI.2H_2O$

F.-pt. data for HI + H_2S (Bagster, 1911), HI + $(CH_3)_2O$. (Maass and McIntosh, 1912.)

HYDROBROMIC ACID HBr.

SOLUBILITY IN WATER.

(Roozeboom — Z. physik. Chem. 2, 454, '88; Rec. trav. chim. 4, 107, '85; 5, 358, '86; see also Pickering — Phil. Mag. [5] 36, 119, '93.)

t°.	Gms. HBr Dissolved (at 760–765mm.) per 100 Gms. Water.	Solution.	β.	Gms. HBr Dissolved at Lower Pressures per 100 Gms. H_2O.
− 2.5	255.0	71.83	...	175.0 (10 mm.)
−15	239.0	70.50	...	...
0	221.2	68.85	611.6	...
+10	210.3	67.76	581.4	108.5 (5 mm.)
15	204.0	67.10	...	...
25	193.0	65.88	532.1	...
50	171.5	63.16	468.6	...
75	150.5	60.08	406.7	...
100	130.0	56.52	344.6	...

For β see ethane, p. 285.

F.-pt. data for HBr + H_2S (Bagster, 1911); HBr + $(CH_3)_2O$, HBr + CH_3OH, HBr + C_2H_5OH, HBr + $CH_3COOC_2H_5$ and HBr + $C_6H_5CH_3$.

(Maass and McIntosh, 1912.) (Reid and McIntosh, 1916.)

HYDROCHLORIC ACID HCl.

SOLUBILITY IN WATER BY THE FREEZING-POINT METHOD.

(Composite curve from results of Roloff, 1895; Pickering, 1893(a); Roozeboom, 1884, 1889 and Rupert, 1909.)

t°.	Gms HCl per 100 Gms. Sat Sol.	Solid Phase.	t°.	Gms. HCl per 100 Gms. Sat Sol.	Solid Phase.
−1.706	1.66	Ice	−18.4	48.6	$HCl.2H_2O$
−14.97	10.02	"	−17.7 m. pt.	50.3	"
−28.84	14.51	"	−18.7	52.85	"
−40	17.40	"	−19.4	54.1	"
−60	21.30	"	−20.8	55.7	"
−80	24.20	"	−21.3	56.5	"
−86 Eutec.	24.8	" +$HCl.3H_2O$	−23.2	57.3	"
−50	30.1	$HCl.3H_2O$	−23.5 Eutec.	...	" +$HCl.H_2O$
−40	32.7	"	−21.5	58.2	$HCl.H_2O$
−30	36.5	"	−20.7	59.1	"
−24.9 m. pt.	40.3	"	−18.4	61.1	"
−27.5	44	" +$HCl.2H_2O$	−17.4	62.4	"
−23.8	45.7	$HCl.2H_2O$	−15.4	65.4	"
−21.2	45.9	"	−15.35	66.8	"

At about −15.35 two liquid layers are formed. Data for these are as follows:

HCl layer. t° of Saturation	Gms. H_2O per 100 Gms. Sat. Sol.	H_2O layer. t°.	Gms HCl per 100 Gms. Sat. Sol.	d. of Sat. Sol.	t°.	Gms. HCl per 100 Gms. Sat. Sol.	d. of Sat. Sol.
Below −50	0.008	−20	67.65	1.279	15	64.70	1.231
" −50	0.017	−15	67.29	1.269	20	64.19	1.228
Bet. −15 and 0°	0.077	−10	66.71	1.260	30	63.21	1.229
Above 45	0.021	−5	66.44	1.255	35	62.90	1.227
"	0.052	0	65.85	1.247	40	62.27	1.218
"	0.11	+5	65.48	1.245	45	61.76	1.212
"	0.13	10	65.18	1.240	50	61.65	1.219

For additional data on this system see Baume and Tykociner, 1914.

HYDROCHLORIC ACID HCl.

SOLUBILITY IN WATER AT DIFFERENT TEMPERATURES AND PRESSURES.

(Deicke; Roscoe and Dittmar — Liebig's Ann. 112, 334, '59; below 0°, Roozeboom — Rec. trav. chim. 3, 104, '84.)

	At Different Temperatures and 760 mm. Pressure.				At Different Pressures and 0°	
t°.	cc. HCl per 100 cc. H_2O.	Density.	Gms. HCl per 100 g. Sol.	Gms. HCl per 100 g. H_2O.	Pressures.*	Gms. HCl per 100 g. H_2O
0	525.2	1.2257	45.15	82.31	60	61.3
4	497.7	1.2265	44.36	79.73	100	65.7
8	480.3	1.2185	43.83	78.03	150	68.6
12	471.3	1.2148	43.28	76.30	200	70.7
14	462.4	1.2074	42.83	74.92	300	73.8
18	451.2	1.2064	42.34	73.41	400	76.3
23	435.0	1.2014	41.54	71.03	500	78.2
30	...	..	40.23	67.3	600	80.0
40	...	...	38.68	63.3	750	82.4
50	...	...	37.34	59.6	1000	85.6
60	...	...	35.94	56.1	1300	89.5

* Pressures in mm. Hg minus tension of H_2O vapor.

SOLUBILITY IN WATER AT TEMPERATURES BELOW 0°.

At a pressure of 760 mm.

t°.	q.	t°.	q.
−24	101.2	−15	93.3
−21	98.3	−10	89.8
−18.3	96	−5	86.8
−18	95.7	0	84.2

At pressures below and above 760 mm.

t°.	mm. Pressure.	q.
−23.8	...	84.2
−21	334	86.8
−19	580	92.6
−18	900	98.4
−17.7	1073	101.4

For definition of q, see Ethane, p. 285.

The eutectic is at −86° and 33 gms. HCl per 100 gms. H_2O.

SOLUBILITY OF HYDROCHLORIC ACID GAS IN METHYL ALCOHOL, ETHYL ALCOHOL, AND IN ETHER AT 760 MM. PRESSURE.

(de Bruyn — Rec. trav. chim. 11, 129, '92; Schuncke — Z. physik. Chem. 14, 336, '94.)

t°.	Grams HCl gas per 100 Grams Solution in:		
	CH_3OH.	C_2H_5OH.	$(C_2H_5)_2O$.
−10	54.6	...	37.51 (−9.2°)
−5	...	...	37.0
0	51.3	45.4	35.6
+5	...	44.2 (6.5°)	33.1
10	...	42.7 (11.5°)	30.35
15	...	...	27.62
20	47.0 (18°)	41.0	24.9
25	...	40.2 (23.5°)	22.18
30	43.0 (31.7°)	38.1 (32°)	19.47

SOLUBILITY OF HYDROCHLORIC ACID GAS IN AQ. SULFURIC ACID SOLUTIONS.
(Coppadoro, 1909.)

Results at 17°.			Results at 40°.			Results at 70°.		
d of Sat. Sol.	Gms. per 100 Gms. Sat. Sol.		d of Sat. Sol.	Gms. per 100 Gms. Sat. Sol.		d of Sat. Sol.	Gms. per 100 Gms. Sat. Sol.	
	H_2SO_4.	HCl.		H_2SO_4.	HCl.		H_2SO_4.	HCl.
1.211	0	42.7	1.185	3.56	35.6	1.145	1.61	32.7
1.220	1.86	39.9	1.195	5.86	34.8	1.150	3.38	31.1
1.220	4.75	39.2	1.210	8.90	32.4	1.160	4.80	30.5
1.235	8.04	36.9	1.255	16.80	27.6	1.180	7.93	28.9
1.260	12.80	33.2	1.255	18.8	25.9	1.225	18.9	22.8
1.305	20.9	28.5	1.340	28.6	18.5	1.230	20	22.3
1.355	30.8	22.6	1.400	44.2	11.5	1.315	36.2	13.2
1.430	44.6	15	1.520	61.1	3.35	1.380	48	6.99
1.545	59.4	6.26	1.575	66.4	1.17	1.510	62.7	1.56
1.580	65.4	3.25	1.650	73.2	0.17	1.560	67.6	0.54
1.660	73.7	0.62	1.725	79.4	0.081	1.700	80.7	0.05
1.735	77.5	0.11	1.755	81.4	0.032	1.745	83	0.035
1.815	89	0.068	1.770	83.5	0.029	1.745	83.4	0.032

MISCIBILITY OF HYDROCHLORIC ACID WITH MIXTURES OF WATER AND PHENOL AT 12°.
(Schreinemakers and van der Horn van der Bos, 1912.)

Composition of the Reciprocally Saturated Liquid Pairs.				Composition of the Solutions in Contact with Solid Phenol.		
Water Rich Layer		Phenol Rich Layer.				
% HCl.	% Phenol.	% HCl	% Phenol.	% Water.	% HCl	% Phenol.
0	7.45	0	72	11.22	0	88.78
3.1	6.6	0.09	78	84.5	10.7	4.8
6.6	5.3	0.2	80.3	80.38	15.64	3.98
8	5.1	0.36	82.6	72.43	24.37	3.2
10.7	4.8	0.52	84.5	60.25	36.25	3.5

Additional data for this system are given by Krug and Cameron, 1900.

FREEZING-POINT DATA (Solubility, see footnote, p. 1) FOR MIXTURES OF HYDROCHLORIC ACID AND OTHER COMPOUNDS.

Hydrochloric Acid + Hydrogen Sulfide (Baume and Georgitses. 1912, 1914)
" + Methyl Alcohol (Baume and Borowski, 1914, Baume and Pamfil, 1911, 1914; Maass and McIntosh, 1913.)
" + Methyl Chloride (Baume and Tykociner, 1914)
" + Methyl Ether (Maass and McIntosh, 1912; Baume, 1911, 1914.)
" + Propionic Acid (Baume and Georgitses, 1912, 1914.)
" + Sulfur Dioxide (Baume and Pamfil, 1911, 1914.)

HYDROCYANIC ACID HCN.

DISTRIBUTION BETWEEN WATER AND BENZENE.
(Hantzsch and Sebalt, 1899; Hantzsch and Vagt, 1901)

t°.	Mol. HCN per Liter: H_2O Layer (c).	Mol. HCN per Liter: C_6H_6 Layer (c').	$\frac{c}{c'}$.	t°.	Mol. HCN per Liter: H_2O Layer (c).	Mol. HCN per Liter: C_6H_6 Layer (c').	$\frac{c}{c'}$.
6	0.00625	0.00325	1.923	7	0.0574	0.0148	3.88
16	0.00593	0.00363	1.634	20	0.0572	0.0154	3.72
25	0.00580	0.00375	1.547				

Data for the effect of HCl and of KCl on the distribution are also given.

HYDROFLUORIC ACID HF.

100 grams H_2O dissolve 111 grams HF at −35°. (Metzner, 1894.)

HYDROGEN H.

SOLUBILITY IN WATER.

(Winkler — Ber. 24, 99, '91; Bohr and Bock — Wied. Ann. 44, 318, '91; Timofejew — Z. physik. Chem. 6, 147, '90.)

t°.	β'.	l.		β.	q.
0	0.0214	...	...	0.0214	0.000193
5	0.0203	0.0209	— 0.0241	0.0204	0.000184
10	0.0193	0.0204	— 0.0229	0.0195	0.000176
15	0.0185	0.0200	— 0.0217	0.0188	0.000169
20	0.0178	0.0196	— 0.0205	0.0182	0.000162
25	0.0171	0.0193	— 0.0191	0.0175	0.000156
30	0.0163	...	...	0.0170	0.000147
40	0.0153	...	...	0.0164	0.000139
50	0.0141	...	...	0.0161	0.000129
60	0.0129	...	...	0.0160	0.000119
80	0.0085	...	...	0.0160	0.000079
100	0.0000	...	...	0.0160	0.000000

l = Ostwald Solubility Expression, see p. 227. For β', β, and q, see Ethane, p. 285.
Data for the solubility of hydrogen in water at pressures up to 10 atmospheres are given by Cassuto, 1913.

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF ACIDS AND BASES AT 25°.

(Geffcken — Z. physik. Chem. 49, 268, '04.)

Gram Equiv. Acids and Bases per Liter.	Solubility of H (l_{25} = Ostwald Expression) in Solutions of: HCl.	HNO_3.	$\frac{1}{2}H_2SO_4$.	CH_3COOH.	$CH_2ClCOOH$.	KOH.	NaOH.
0.0	0.0193	0.0193	0.0193	0.0193	0.0193	0.0193	0.0193
0.5	0.0186	0.0188	0.0185	0.0192	0.0189	0.0167	0.0165
1.0	0.0179	0.0183	0.0177	0.0191	0.0186	0.0142	0.0139
2.0	0.0168	0.0174	0.0163	0.0188	0.0180	...	0.0097
3.0	0.0159	0.0167	0.0150	0.0186	...	...	0.0072
4.0	...	0.0160	0.0141	0.0186	...	...	0.0055

The above figures for the concentrations of acids and bases were calculated to grams per liter, and these values with the corresponding l_{25} values for the solubility of hydrogen, plotted on cross-section paper. From the resulting curves, the following table was read:

Grams Acids and Bases per Liter.	Solubility of H (l_{25} = Ostwald Expression) in Solutions of: HCl.	HNO_3.	$\frac{1}{2}H_2SO_4$.	CH_3COOH.	$CH_2ClCOOH$.	KOH.	NaOH.
0	0.0193	0.0193	0.0193	0.0193	0.0193	0.0193	0.0193
20	0.0185	0.0189	0.0186	0.0192	0.0191	0.0172	0.0165
40	0.0179	0.0186	0.0180	0.0191	0.0190	0.0153	0.0140
60	0.0173	0.0183	0.0174	0.0190	0.0188	0.0135	0.0117
80	0.0167	0.0180	0.0168	0.0189	0.0187	...	0.0097
100	0.0160	0.0179	0.0162	0.0189	0.0185	...	0.0082
150	...	0.0171	0.0148	0.0188	0.0182	...	0.0058
200	...	0.0165	0.0140	0.0186	0.0179	...	...
250	...	0.0160	.	0.0184	...	...	...

For Ostwald Solubility Expression l, see p. 227.

THE SOLUBILITY OF HYDROGEN IN CONC. H_2SO_4 AT 20°.

(Christoff, 1906.)

% H_2SO_4	0	35.82	61.62	95.6
l_{20}	0.0208	0.00954	0.00708	0.01097

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF AMMONIUM NITRATE AT 20°.

(Knopp — Z. physik. Chem. 48, 103, '04.)

p.	Normality (per 1000 Gms.) H_2O.	Molecular Concentration.	Absorption Coefficient of Hydrogen.	Density of Solutions.
0.00	0.00	0.00	0.0188	...
1.037	0.1308	0.002352	0.01872	1.0027
2.167	0.2765	0.004956	0.01845	1.0072
3.378	0.4363	0.007799	0.01823	1.0122
4.823	0.6333	0.011280	0.01773	1.0182
6.773	0.9069	0.016447	0.01744	1.0262
11.550	1.6308	0.028525	0.01647	1.04652

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF BARIUM CHLORIDE.

(Braun — Z. physik. Chem. 33, 735, '00.)

Gms. $BaCl_2$ per 100 Gms. Solution.	Coefficient of Absorption of Hydrogen at: 5°.	10°.	15°.	20°.	25°.
0.00	0.0237	0.0221	0.0206	0.0191	0.0175
3.29	0.0211	0.0198	0.0185	0.0172	0.0157
3.6	0.0209	0.0197	0.0184	0.0170	0 0156
6.45	0.0196	0.0186	0.0173	0 0161	0.0147
7.00	0.0194	0.0183	0.0172	0.0159	0.0146

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF CALCIUM CHLORIDE, MAGNESIUM SULPHATE, AND LITHIUM CHLORIDE AT 15°.

(Gordon — Z. physik. Chem. 18, 14, '95.)

Coefficient of Absorption of hydrogen in water at 15° = 0.01883.

In Calcium Chloride. Gms. $CaCl_2$ per 100 g. Sol.	G. M. $CaCl_2$ per Liter.	Absorption Coefficient of H.	In Magnesium Sulphate. Gms. $MgSO_4$ per 100 g. Sol.	G. M. $MgSO_4$ per Liter.	Absorption Coefficient of H.	In Lithium Chloride. Gms. LiCl per 100 g. Sol.	G. M. LiCl per Liter.	Absorption Coefficient of H.
3.47	0.321	0.01619	4.97	0.433	0.01501	3.48	0.835	0.01619
6.10	0.578	0.01450	10.19	0.936	0.01159	7.34	1.800	0.01370
11.33	1.122	0.01138	23.76	2.501	0.00499	14.63	3.734	0.0099
17.52	1.1827	0.00839						
26.34	2.962	0.00519						

For definition of Coefficient of Absorption, see page 227.

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF POTASSIUM CARBONATE, CHLORIDE, AND NITRATE AT 15°.

(Gordon.)

In Potassium Carbonate. Gms. K_2CO_3 per 100 g. Sol.	G. M. K_2CO_3 per Liter.	Absorption Coefficient of H.	In Potassium Chloride. Gms. KCl per 100 g. Sol.	G. M. KCl per Liter.	Absorption Coefficient of H.	In Potassium Nitrate. Gms. KNO_3 per 100 g. Sol.	G. M. KNO_3 per Liter.	Absorption Coefficient of H.
2.82	0.209	0.01628	3.83	0.526	0.01667	4.73	0.482	0.01683
8.83	0.690	0.01183	7.48	1.051	0.01489	8.44	0.879	0.01559
16.47	1.376	0.00761	12.13	1.755	0.01279	16.59	1.820	0.01311
24.13	2.156	0.00462	19.21	2.909	0.01012	21.46	2.430	0.01180
41.81	4.352	0.00160	22.92	3.554	0.00892			

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AND NITRATE AT 20°.

(Knopp — Z. physik. Chem. 48, 103, '04.)

In Potassium Chloride.				In Potassium Nitrate.			
p.	Normality (per 1000 g. H_2O).	Absorption Coefficient.	Density of Solutions.	p.	Normality (per 1000 g. H_2O).	Absorption Coefficient.	Density of Solutions.
1.089	0.1475	0.01823	1.0052	1.224	0.1245	0.01835	1.0059
2.123	0.2907	0.01757	1.0118	2.094	0.2114	0.01818	1.0113
4.070	0.5687	0.01661	1.0243	4.010	0.4127	0.01785	1.0236
6.375	0.9127	0.01531	1.0394	5.925	0.6225	0.01743	1.0359
7.380	1.0682	0.01472	1.0460	7.742	0.8293	0.01667	1.0477
13.612	2.1222	0.01255	1.0875	13.510	1.5436	0.01436	1.0865

SOLUBILITY OF HYDROGEN IN AQUEOUS SODIUM CARBONATE AND SULPHATE SOLUTIONS AT 15°.

(Gordon.)

In Sodium Carbonate.			In Sodium Sulphate.		
Gms. Na_2CO_3 per 100 Gms. Solution.	G.M. Na_2CO_3 per Liter.	Absorption Coefficient of H.	Gms. Na_2SO_4 per 100 Gms. Solution.	G. M. Na_2SO_4 per Liter.	Absorption Coefficient of H.
2.15	0.207	0.01639	4.58	0.335	0.01519
8.64	0.438	0.01385	8.42	0.638	0.0154
11.53	1.218	0.00839	16.69	1.364	0.00775

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE.

(Braun; Gordon.)

Gms. NaCl per 100 Gms. Solution	Coefficient of Absorption of Hydrogen at:				
	5°.	10°.	15°.	20°.	25°.
1.25	0.0218	0.0205	0.0191	0.0177	0.0162
3.80	0.0198	0.0188	0.0176	0.0162	0.0148
4.48	0.0192	0.0182	0.0171	0.0159	0.0143
6.00	0.0184	0.0175	0.0164	0.0153	0.0138
14.78	..	...	0.0093	...	...
23.84	...	...	0.00595	...	...

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF SODIUM NITRATE.

In Sodium Nitrate at 20°. (Knopp.)				In Sodium Nitrate at 15°. (Gordon.)		
p.	Normality (per 1000 Gms. H_2O).	Absorption Coefficient of H.	Density of Solutions.	Gms. $NaNO_3$ per 100 Gms. Solution.	G. M. $NaNO_3$ per Liter.	Absorption Coefficient of H.
1.041	0.1236	0.01839	1.0052	5.57	0.679	0.01603
2.192	0.2634	0.01774	1.0130	11.16	1.413	0.0137
4.405	0.5416	0.01694	1.0282	19.77	2.656	0.01052
6.702	0.8442	0.01518	1.04411	37.43	5.711	0.00578
12.637	1.7354	0.0130	1.08667			

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF VARIOUS SALTS AT 15°.

(Steiner, 1894)

Salt in Aq. Solution.	Bunsen Absorption Coefficient β ($\times 10^4$) in Aq. Solution of Normality.								
	0	1.	2.	3.	4	5.	6.	7.	9.
LiCl	1883	1574	1325	1121	949	...	...	...	...
KNO_3	1883	1524	1276	1076	...	...	...	...	...
$\frac{1}{3}AlCl_3$	1883	1511	1221	993	810	667	550	...	...
KCl	1883	1502	1217	996	820	...	...	...	...
$NaNO_3$	1883	1496	1201	984	808	667	542	...	...
$\frac{1}{2}CaCl_2$	1883	1493	1195	958	780	635	510	...	...
NaCl	1883	1478	1144	880	699	573	...	...	...
$\frac{1}{2}MgSO_4$	1883	1451	1120	856	659	499	...	...	...
$\frac{1}{2}ZnSO_4$	1883	1446	1113	852	667	510	...	...	...
$\frac{1}{2}Na_2SO_4$	1883	1370	991	710	...	...	...	...	...
$\frac{1}{2}K_2CO_3$	1883	1338	967	700	508	372	273	206	158
$\frac{1}{2}Na_2CO_3$	1883	1340	699	...	...	...	...	...	...
Cane Sugar	1883	1280	731	...	...	...	...	...	...

SOLUBILITY OF HYDROGEN IN ALCOHOL. (Timofeiew, 1890; Bunsen-Heurich, 1892)

t°.	Coef of Absorption in 98.8% Alcohol.	t°.	Coef of Absorption in 7% Alcohol	t°.	Coef of Absorption in Pure Alcohol (Bunsen)
0	0.0676	4	0.0749	1	0.06916
6.2	0.0693	18.8	0.0740	5	0.06847
13.4	0.0705			11.4	0.06765
				23.7	0.06633

SOLUBILITY IN AQUEOUS ALCOHOL SOLUTIONS AT 20° AND 760 MM. PRESSURE.

(Lubarsch, 1889)

Wt. % Alcohol.	Vol. % Absorbed H.	Wt. % Alcohol	Vol. % Absorbed H.
0	1.93	28.57	1.04
9.09	1.43	33.33	1.17
16.67	1.29	50	2.02
23.08	1.17	66.67	2.55

SOLUBILITY OF HYDROGEN IN AQ. SOLUTIONS OF CHLORAL HYDRATE.

(Müller, C. 1912–13)

t°.	Gms. Chloral Hydrate per 100 Gms Aq. Sol.	d_{20} of Aq. Solution	Absorption Coefficient. β_t.	β_{20}
19.4	15.5	1.0722	0.01732	0.01724
17.4	28.3	1.143	0.01569	0.01540
18.7	46.56	1.2505	0.01388	0.01375
16.5	52	1.2870	0.01314	0.01280
17	63	1.371	0.01270	0.01243
17.9	68	1.4097	0.01286	0.01270
18.3	78.4	1.4993	0.01398	0.01380

SOLUBILITY OF HYDROGEN IN CHLORAL HYDRATE SOLUTIONS AT 20°. (Knopp, 1904.)

p.	Normality (per 1000 Gms. H_2O).	Molecular Concentration	Absorption Coefficient of H.	Density of Solutions.
4.91	0.310	0.005594	0.01839	1.0202
7.69	0.504	0.008992	0.01802	1.0320
14.56	1.030	0.018223	0.01712	1.0669
29.50	2.530	0.043601	0.01542	1.1466
38.42	3.770	0.063647	0.01440	1.1982
49.79	6	0.097493	0.01353	1.2724
63.90	10.700	0.161660	0.01307	1.3743

For definition of Bunsen Absorption Coef., see p. 227.

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF GLYCEROL.

Results at 14° and 21°. (Henkel, 1905, 1912.) Results at 25°. (Drucker and Moles, 1910.)

t°.	Wt. % Glycerol.	Absorp. Coef. β (See p. 227.)	Wt. % Glycerol.	d_{25} Sat. Sol.	l_{25} (Ostwald Expression).
14	0	0.0193	0	1	0.0196
"	2.29	0.0189	4	1.0101	0.0186
"	5.32	0.0186	10.5	1.0260	0.0178
"	8.57	0.0182	22	1.0542	0.0154
"	10.83	0.01815	49.8	1.1290	0.0099
"	15.31	0.01765	50.5	1.1300	0.0097
21	0	0.0184	52.6	1.1365	0.0090
"	2.29	0.0181	67	1.1752	0.0067
"	5.68	0.0177	80	1.2113	0.0051
"	6.46	0.0176	82	1.2159	0.0051
"	10.40	0.0171	88	1.2307	0.0044
"	18.20	0.0160	95	1.2502	0.0034

Additional data for this system are given by Müller, C. 1912-13.

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF SEVERAL COMPOUNDS.
(Hüfner, 1906-07.)

Aqueous Solution of:	Conc. of Solvent Gms. per Liter.	t.	Absorption Coef. β.
Water alone	0	20.11	0.0181
Dextrose (Grape Sugar)	41.45	20	0.0176
"	87.3	20.25	0.0166
"	174	20.28	0.0152
Urea	60	20.17	0.0170
Acetamide	59	20.11	0.0180
Alanine	89	20.08	0.0156
Glycocol	75	20.16	0.0158

SOLUBILITY OF HYDROGEN IN AQUEOUS SOLUTIONS OF CANE SUGAR AND OF GRAPE SUGAR. (Müller, C. 1912-13)

t°.	Wt. % Cane Sugar.	Sp. Gr Sat. Sol.	Abs Coef. β_{15}.	t°.	Wt % Grape Sugar.	Sp. Gr. Sat. Sol.	Abs. Coef. β_{20}.
15.2	5.04	$d_{15}=1.019$	0.0173	19.3	0	...	0.0184
11.6	14.7	$d_{11}=1.060$	0.0151	20.5	12.2	$d_{20}=1.048$	0.0160
12	20.26	$d_{11}=1.084$	0.0146	20.5	20.7	$d_{20}=1.084$	0.0145
12.7	29.86	$d_{13}=1.128$	0.0126	21.1	32.56	$d_{20}=1.130$	0.0125
11.8	31.74	$d_{12}=1.138$	0.0119	21.8	45.8	$d_{20}=1.199$	0.0102
13.3	39.65	$d_{13.5}=1.175$	0.0103	21.2	59	$d_{20}=1.266$	0.0078
12.6	42.94	$d_{12.5}=1.195$	0.0094				

SOLUBILITY OF HYDROGEN IN AQUEOUS SUGAR SOLUTIONS AT 15°. (Gordon, 1895.)

Gms. Sugar per 100 Gms Solution.	Gm. Mols. Sugar per Liter.	Absorption Coefficient of H.
16.67	0.520	0.01561
30.08	0.993	0.01284
47.65	1.699	0.00892

SOLUBILITY OF HYDROGEN AT 25° (Findlay and Shen, 1912) IN AQ. SOLUTIONS OF:

Dextrin.			Starch.			Gelatin.	
Gms. Dextrin per 100 cc.	Sp. Gr.	l_{25}.	Gms. Starch per 100 cc.	Sp. Gr.	l_{25}.	Gms. Gelatin per 100 cc.	l_{25}.
3.98	1.012	0.0194	2.01	1.005	0.0194	1.53	0.0194
8.58	1.019	0.0191	3.56	1.011	0.0189	2.69	0.0189
8.12	1.028	0.0188	7.13	1.024	0.0181	4.74	0.0185
19.20	1.066	0.0174	9.29	1.032	0.0182	5.71	0.0182

SOLUBILITY OF HYDROGEN IN AQUEOUS PROPIONIC ACID SOLUTIONS.
(Braun, 1900.)

Gms. C_2H_5COOH per 100 Gms. Solution.	Coefficient of Absorption of Hydrogen at: 5°.	10°.	15°.	20°.	25°.
2.63	0.02245	0.0214	0.0200	0.0188	0.0172
3.37	0.0222	0.0212	0.0199	0.0187	0.0171
5.27	0.0224	0.0212	0.0198	0.0184	0.0171
6.50	0.0218	0.0209	0.0193	0.0183	0.0169
9.91	0.0213	0.0203	0.0191	0.0178	0.0160

SOLUBILITY OF HYDROGEN IN RUSSIAN PETROLEUM.
(Gniewasz and Walfisz, 1887.)

Coefficient of absorption (see p. 227) at 20° = 0.0582, at 10° = 0.0652.

SOLUBILITY OF HYDROGEN IN WATER AND IN ORGANIC SOLVENTS.

Results in terms of the Ostwald Expression, see p. 227. (Just, 1901.)

Solvent.	l_{25}.	l_{20}.	Solvent.	l_{25}.	l_{20}.
Water	0.0199	0.0200	Amyl Acetate	0.0774	0.0743
Aniline	0.0285	0.0303	Xylene	0.0819	0.0783
Amyl Alcohol	0.0301	0.0353	Ethyl Acetate	0.0852	0.0788
Nitrobenzene	0.0371	0.0353	Toluene	0.0874	0.0838
Carbon Disulfide	0.0375	0.0336	Ethyl Alcohol (98.8%)	0.0894	0.0862
Acetic Acid	0.0633	0.0617	Methyl Alcohol	0.0945	0.0902
Benzene	0.0756	0.0707	Isobutyl Alcohol	0.0976	0.0929
Acetone	0.0764	0.0703			

SOLUBILITY OF HYDROGEN IN ETHYL ETHER.
(Christoff, 1912.)

Results in terms of the Ostwald Solubility Expression l (see p. 227).

$$l_0 = 0.1115, \quad l_5 = 0.1150, \quad l_{10} = 0.1195, \quad l_{15} = 0.1259.$$

Data for the solubility of hydrogen in metals are given by Sieverts and coworkers, 1909, 1910, 1912.

HYDROGEN PEROXIDE H_2O_2.

DISTRIBUTION OF HYDROGEN PEROXIDE BETWEEN WATER AND AMYL ALCOHOL AT 0° AND AT 25°.
(Calvert, 1901; Joyner, 1912.)

Results at 0°. (Calvert, Joyner.) Mols. H_2O_2 per Liter. H_2O layer (W).	Alcohol Layer (A).	$\frac{W}{A}$.	Results at 25°. (Calvert.) Mols. H_2O_2 per Liter. H_2O Layer (W).	Alcohol Layer (A).	$\frac{W}{A}$.
0.146	0.0216	6.76	0.094	0.013	7.01
0.200	0.030	6.66	0.194	0.028	6.91
0.407	0.061	6.63	0.297	0.042	7.08
0.749	0.113	6.66	0.670	0.095	7.09
1.970	0.293	6.71	0.913	0.130	7.01

Data are also given for the distribution of hydrogen peroxide between aqueous sodium hydroxide solutions and amyl alcohol at 0° and at 25°.

DISTRIBUTION OF HYDROGEN PEROXIDE BETWEEN WATER AND ORGANIC SOLVENTS.
(Walton and Lewis, 1916.)

Different amounts of perhydrol (30% H_2O_2 solution) were added to various mixtures of water and organic solvents and, after constant agitation for about 1 hour, the H_2O_2 in each layer was determined.

Solvent	t°.	Ratio, Conc aq / Conc. org solvent	Solvent.	t°.	Ratio, Conc aq. / Conc. org. solvent
Ethyl Acetate	25	3.92– 4.11	Methyl Iodide	25	Approx. 200
Isobutyl Alcohol	25	2.58– 2.63	*m* Toluidine	25	Approx. 5
Amyl Acetate	25	13 –13.2	Phenol	25	4.35 –5.55
Acetophenone	25	5 82– 6.06	Quinoline	0	0.276–0.391
Ether	25	8.28– 9.11	"	25	0 365–0.642
Ether	0	5.72– 5.85	"	40	0.516–0.602
Aniline	25	4.08– 4.10			

The following approximate values, determined at room temp., are quoted from the dissertation of A. Braun, Univ., Wisconsin, 1914.

Solvent.	Ratio, Conc. aq / Conc. org solvent	Solvent.	Ratio, Conc aq / Conc org solvent	Solvent.	Ratio, Conc aq. / Conc. org solvent
Ethyl Acetate	$\frac{2}{5}$	Ethylisovalerianate	$\frac{1}{40}$	Isobutyl Alcohol	$\frac{1}{3}$
Nitrobenzene	$\frac{1}{250}$	Isoamyl Propionate	$\frac{1}{12}$	Propyl Formate	$\frac{1}{8}$
Acetophenone	$\frac{1}{4}$	Chloroform	$\frac{1}{600}$	Isobutyl Butyrate	$\frac{1}{50}$
Amyl Acetate	$\frac{1}{8}$	Benzene	$\frac{1}{250}$	Propyl Butyrate	$\frac{1}{30}$

The distribution ratio of hydrogen peroxide between water and ether at 17.5° varies with concentration from 13.9 to 17.4. (Osipoff and Popoff, 1903)

HYDROGEN SELENIDE H_2Se

SOLUBILITY IN WATER.
(de Forcrand and Fonzes-Diacon, 1902.)

t°.	4°	9.65	13.2	22.5
Vol. H_2Se (at 0° and 760 mm.) dissolved per 1 vol. H_2O	3.77	3.45	3.31	2.70

HYDROGEN SULFIDE H_2S.

SOLUBILITY IN WATER.
(Winkler, 1906, 1912)

t°.	Abs. Coef β	q.	t°.	Abs. Coef. β.	q.	t°.	Abs. Coef. β.	q.
0	4.621	0 699	25	2 257	0.334	60	1.176	0.146
5	3.935	0.593	30	2.014	0.295	70	1.010	0.109
10	3.362	0.505	35	1.811	0.262	80	0 906	0.076
15	2.913	0 436	40	1.642	0.233	90	0.835	0.041
20	2.554	0.380	50	1.376	0.186	100	0.800	0

SOLUBILITY IN WATER AND IN ALCOHOL AT t° AND 760 MM. PRESSURE.
(Bunsen and Carius, Fauser, 1888.)

	In Water.				In Alcohol.	
t°.	1 Vol H_2O Absorbs		β	q.	1 Vol Alcohol Absorbs.	
0	4.37	Vols. H_2S (at 0° and 760 mm)	4.686	0 710	17.89	Vols. H_2S (at 0° and 760 mm.)
5	3.97	"	4.063	0.615	14.78	"
10	3.59	"	3.520	0.530	11.99	"
15	3.23	"	3.056	0.458	9.54	"
20	2.91	"	2.672	0.398	7.42	"
25	2.61	"	...	...	5.96 (24°)	"
30	2.33	"	...	...	...	
35	2.08	"	...	...	...	
40	1.86	"	...	...	...	

For β and *q* see Ethane, page 285.
The *PT* and the *Px* curves for the system $H_2S + H_2O$ are given by Scheffer, 1911.

SOLUBILITY OF HYDROGEN SULFIDE IN AQUEOUS SOLUTIONS OF HYDRIODIC ACID AT 25° AND 760 MM. TOTAL PRESSURE.

(Pollitzer, 1909.)

Mols. per Liter.			Gms. per Liter.		Mols. per Liter.			Gms. per Liter.	
[H'].	[HI].	[H_2S].	HI.	H_2S.	[H'].	[HI].	[H_2S].	HI.	H_2S.
0.20	0	0.1040	0	3.54	4.71	4.38	0.163	560.4	5.55
1.23	1.01	0.111	129.2	3.78	5.33	5.005	0.165	640.3	5 62
1.74	1.51	0.113	193.2	3.85	6.06	5.695	0.181	728.6	6.17
2.18	1.93	0.125	246.9	4.26	7.33	6.935	0.197	887.2	6.71
2.92	2.64	0.138	337 8	4.70	9.75	9.21	0.267	1179	9.10
3.71	3.42	0.142	437.5	4.84					

Data for the solubility of hydrogen sulfide in liquid sulfur are given by Pelabon, 1897.

Freezing-point lowering data for mixtures of H_2S and CH_3OH and H_2S and $(CH_3)_2O$ are given by Baume and Perrot, 1911, 1914.

SOLUBILITY OF HYDROGEN SULFIDE IN AQUEOUS SALT SOLUTIONS AT 25°.

(McLauchlan, 1903)

NOTE. — The original results are given in terms of $\frac{l}{l_0}$ which is the iodine titer (l) of the H_2S dissolved in the salt solution, divided by the titer (l_0), of the H_2S dissolved in pure water. These figures were multiplied by 2.61 (see 25° result in last table on page 322) and the products recorded in the following table as volumes of H_2S absorbed by 1 vol. of aqueous solution.

Solution.	Grams Salt per Liter.	$\frac{l}{l_0}$.	Vols H_2S per 1 Vol. Sol.	Solution.	Gms. Salt per Liter.	$\frac{l}{l_0}$.	Vols. H_2S per 1 Vol. Sol.
$n\ NH_4Br$	98	1	2.61	$n\ KBr$	119	0.945	2.47
$n\ NH_4Cl$	53.4	0.96	2.40	$n\ KCl$	74.5	0.853	2.22
$n\ NH_4NO_3$	80	0.99	2.58	$n\ KNO_3$	101	0.913	2.38
$\frac{1}{2}n\ (NH_4)_2SO_4$	33	0.82	2.14	$\frac{1}{2}n\ K_2SO_4$	43 5	0.78	2.04
$\frac{1}{4}n\ (NH_4)_2SO_4$	16.5	0.91	2.37	$\frac{1}{4}n\ K_2SO_4$	21.7	0 89	2.32
$n\ NH_4C_2H_3O_2$	77.1	1.09	2 84	$n\ KI$	166	0 98	2.56
$n\ (NH_2)_2CO$	60.1	1 02	2 66	$n\ NaBr$	103	0 935	2.44
$\frac{1}{2}n\ HCl$	18.22	0.975	2.54	$n\ NaCl$	58 5	0 847	2.21
$\frac{1}{2}n\ H_2SO_4$	24.52	0.905	2 36	$\frac{1}{2}n\ NaCl$	29 2	0 93	2.42
$n\ C_4H_6O_6$	150	0.944	2 46	$n\ NaNO_3$	85	0.893	2.32
$3n\ C_4H_6O_6$	450	0.858	2 24	$\frac{1}{2}n\ Na_2SO_4$	35.5	0 73	1.90
Pure $C_3H_5(OH)_3$	1000	0.863	2.26	$\frac{1}{4}n\ Na_2SO_4$	17.8	0.855	2.23

Similar data are also given for the solubility of H_2S in aq. C_2H_5OH solutions and in aq. CH_3COOH solutions at 25°.

HYDROQUINOL (Hydroquinone) $C_6H_4(OH)_2$ *p*.

100 gms. sat. solution in water contain 6.7 gms. hydroquinol at 20°, Sp. Gr. of sol. = 1.012. (Vaubel, 1899.)

100 gms. 95% formic acid dissolve 6.07 gms. hydroquinol at 20.2°. (Aschan, 1913.)

SOLUBILITY OF HYDROQUINOL IN SULFUR DIOXIDE IN THE CRITICAL VICINITY.
(Centnerswer and Teletow, 1903.)

Determinations made by the Synthetic Method, for which see Note, p. 16.

t°.	Gms. Hydroquinol per 100 Gms. SO_2	t°.	Gms. Hydroquinol per 100 Gms. SO_2	t°.	Gms. Hydroquinol per 100 Gms. SO_2
63	0.89	117.6	4.46	136.7	10.31
73.5	1.22	123.3	5.66	141.4	13.3
89.2	2.18	134.2	8.31	145	14.9

DISTRIBUTION OF HYDROQUINOL BETWEEN WATER AND ETHER AT 15°.
(Pinnow, 1911.)

Conc.* Hydroquinol in:		Conc. Hydroquinol in:	
H_2O Layer.	Ether Layer.	H_2O Layer.	Ether Layer.
0.00502	0.0111	0.0502	0.1275
0.01196	0.0249	0.0818	0.2343
0.0128	0.0274	0.1105	0.3543
0.0236	0.0552	0.1411	0.5300
0.0455	0.1148	0.1502	0.5604

* The terms in which the conc. is expressed are not stated.

FREEZING-POINT DATA (Solubility, see footnote, p. 1) ARE GIVEN FOR THE FOLLOWING MIXTURES:

Hydroquinol and Naphthalene. (Kremann and Janetzky, 1912.)
" " Pyrocatechol. (Jaeger, 1907.)
" " Resorcinol. "
" " *p* Toluidine. (Philip and Smith, 1905.)
Monochlorohydroquinol and Monobromohydroquinol. (Kuster, 1891.)
Diacetylmonochlorohydroquinol and Diacetylmonobromohydroquinol. (Küster, 1911.)

HYDROXYLAMINE $NH_2(OH)$.
HYDROXYLAMINE HYDROCHLORIDE $NH_2(OH).HCl$.

SOLUBILITY OF EACH IN SEVERAL SOLVENTS.
(de Bruyn, 1892.)

Solvent.	t°.	Gms. NH_2OH per 100 Gms. Solution.	t°.	Gms. $NH_2(OH).HC$ per 100 Gms. Solvent.
Methyl Alcohol (abs.)	5	35	19.75	16.4
Ethyl Alcohol (abs.)	15	15	19.75	4.43
Ether (dry)	(b. pt.)	1.2	...	...
Ethyl Acetate	(b. pt.)	1.6	...	...

For densities of $NH_2(OH).HCl$ solutions, see Schiff and Monsacchi, 1896.

Phthalyl**HYDROXYLAMINE** $C_6H_4\left\langle\begin{matrix}CO\\C:NOH\end{matrix}\right\rangle O$.

One liter benzene dissolves 0.33 gm. of the A form of melting point 220°-226°. (Sidgwick, 1915.)

HYOSCYAMINE $C_{17}H_{23}NO_3$.

SOLUBILITY IN SEVERAL SOLVENTS AT 18°-22°.
(Müller, 1903.)

Solvent.	Gms. $C_{17}H_{23}NO_3$ per 100 Gms. Solution.	Solvent.	Gms. $C_{17}H_{23}NO_3$ per 100 Gms. Solution.
Water	0.355	Chloroform	100+
Ether	2.02	Acetic Ether	4.903
Ether sat. with H_2O	3.913	Petroleum Ether	0.098
Water sat. with Ether	3.125	Carbon Tetrachloride	0.059
Benzene	0.769		

HYOSCINE (Scopolamine) **HYDROBROMIDE,** etc.

SOLUBILITY IN SEVERAL SOLVENTS AT 25°. (U. S. P. VIII.)

Solvent.	Hyoscine Hydrobromide $C_{17}H_{21}NO_4HBr.3H_2O$.	Hyoscyamine Hydrobromide $C_{17}H_{23}NO_3.HBr$.	Hyoscyamine Sulfate $(C_{17}H_{23}NO_3)_2H_2SO_4$
	Grams per 100 Grams Solvent.		
Water	66.6	very soluble	very soluble
Alcohol	6.2	50	15.6
Ether	...	0.062	0.04
Chloroform	0.133	40	0.043

Nitro **INDAN** Carboxylic Acids.

Freezing-point lowering data for mixtures of *l* nitroindan-2-carboxylic acid and *d* nitroindan-2-carboxylic acid are given by Mills, Parker and Prowse, 1914.

INDIGO $(C_6H_4\langle{}^{CO}_{NH}\rangle C:)_2$.

100 gms. 95% formic acid dissolve 0.14 gm. indigo at 19.8°. (Aschan, 1913.)

INDIUM IODATE $In(IO_3)_3$.

100 gms. H_2O dissolve 0.067 gm. $In(IO_3)_3$ at 20°. (Mathers and Schluederberg, 1908.)

Iso**INOSITOL** $C_6H_{12}O_6$.

100 gms. H_2O dissolve 25.12 gms. $C_6H_{12}O_2$ at 18° and 43.22 gms. at 100°. (Müller, 1912.)

IODIC ACID HIO_3.

SOLUBILITY OF IODIC ACID IN WATER. (Groschuff, 1906.)

t°.	Gms I_2O_5 per 100 Gms Sat Sol.	Solid Phase.	t°.	Gms I_2O_5 per 100 Gms. Sat. Sol.	Solid Phase.
− 0.3	1.69	Ice	16	71.7	HIO_3
− 1.01	6.81	"	40	73.7	"
− 2.38	26.22	"	60	75.9	"
− 4.72	51.42	"	80	78.3	"
− 6.32	57.61	"	85	78.7	"
−12.25	67.40	"	101	80.8	"
−14	69.10	" $+HIO_3$	110	82.1	$HIO_3+HI_3O_8$
−15	70	(unstable) Ice	125	82.7	HI_3O_8
−19	72	" "	140	83.8	"
0	70.3	HIO_3	160	85.9	"

SOLUBILITY OF IODIC ACID IN NITRIC ACID. (Groschuff.)

t°.	Aq. Solution	27.73% HNO_3 Solution.	40.88% HNO_3 Solution.
	Gms HIO_3 per 100 Gms		
0	74.1	18	9
20	75.8	21	10
40	77.7	27	14
60	80	38	18

IODINE I_2

SOLUBILITY OF IODINE IN WATER. (Hartley, 1908.)

t°.	Gms. I per 1000 Gms. H_2O.
18	0.2765
25	0.3395
35	0.4661
45	0.6474
55	0.9222

The above determinations were made with great care. Results for single temperatures in good agreement with the above are given by Dietz, 1898; Jakowkin, 1895; Noyes and Seidensticker, 1898; Sammet, 1905; Bray and Connolly, 1910, 1911; Herz and Paul, 1914 and Fedotieff, 1911-12.

Solubility of Iodine in Aqueous Mercuric Chloride and in Aqueous Cadmium Iodide Solutions at 25°.

In Aq. $HgCl_2$.
(Herz and Paul, 1914.)

Millimols per Liter.		Gms. per Liter.	
Hg.	I_2.	$HgCl_2$.	I.
0	1.34	0	0 340
94 44	12.94	25.64	3.285
124 42	14 60	33 78	3.706
195 42	18.06	54.29	4 583
334.60	25.43	90.84	6 454

In Aq. CdI_2.
(Van Name and Brown, 1917.)

Gms. per Liter.	
CdI_2.	I.
3 66	2.072
45 78	9.056
91.56	11 386
183.12	14 040

Solubility of Iodine in Very Dilute Aqueous Solutions of Potassium Iodide.

(Determinations made with very great care)

Results at 0°. (Jones and Hartman, 1915)			Results at 25°. (Bray and MacKay, 1910)		Results at 25°. (Noyes and Seidenstricker, 1898.)	
Normality of Aq. KI Sol.	$d_{\frac{0}{4}}$ of Sat Sol.	Gms. I per 100 Gms. Sat Sol.	Normality of Aq KI Sol.	Millimols I_2 per Liter Sat. Sol.	Normality of Aq. KI Sol.	Millimols I_2 per Liter Sat. Sol.
0.000992	1.0002	0 0282	0	1 333	0	1.342
0.00200	1.0004	0 0409	0 001	1.788	0.00083	1 814
0.00500	1.0010	0 0760	0 002	2.266	0 00166	2.235
0.01000	1 0020	0 1356	0 005	3 728	0.00664	4 667
0.01988	1 0044	0 2533	0.010	6.185	0.01329	8 003
0 0500	1.0109	0 609	0 020	11.13	0 02657	4 68
0.09993	1 0219	1.199	0 050	25.77	0.05315	28.03
			0 100	51 35	0.1063	55 28

Solubility of Iodine in Aqueous Solutions of Potassium Iodide at 25° and Vice Versa.

(Parsons and Whittemore, 1911)

(Time of rotation 6 mos. or longer. Duplicate determinations at different lengths of time, were made.)

Sp. Gr. Sat. Sol.	Gms. per 100 Gms. Sat Sol. KI	I	Solid Phase.	Sp Gr. Sat. Sol.	Gms. per 100 Gms. Sat. Sol. KI	I	Solid Phase.
1.349	16.03	18.49	Iodine	3.246	27 92	66 45	KI
1.516	19 70	26.16	"	3.232	29.71	62 81	"
1.769	22 88	36 06	"	2 665	35 80	49.61	"
1.910	23 55	40 52	"	2 539	38 09	44 58	"
2.403	24.78	53 60	"	2 216	44 82	31.01	"
2 904	25	63 12	"	2.066	49.04	23 08	"
3.082	25.18	66 04	"	1 888	54 41	11 63	"
3.316	26	68 09	" +KI	1.733	60.39	0	"

Additional data for this system are given by Bruner, 1898; Hamberger, 1906; and Lami, 1908.

Data for the solubility of iodine in aq. 40% ethyl alcohol and aq. 60% ethyl alcohol solutions of potassium iodide at 25°, are given by Parsons and Corliss, 1910. The solid phases were identified in each case and it was demonstrated that no polyiodides of potassium exist in the solid phase or in solution at 25°.

An extensive series of determinations of the simultaneous solubility of iodine and potassium iodide in nitrobenzene and in other organic solvents, as well as in mixtures of nitrobenzene and other solvents are given by Dawson and Gawler, 1902, and Dawson, 1904. The determinations were made to obtain information on the formation of polyiodides in solution. The molecular ratio of dissolved I_2/KI was found to be 1 or more in all cases. (See also p. 537.)

Freezing-point lowering data, determined by time-cooling curves, for mixtures of iodine and potassium iodide are given by Kremann and Schoulz, 1912. Data for this system are also given by Olivari (1908).

Solubility of Iodine in Aqueous Solutions of Potassium Bromide and of Sodium Bromide at 25°.

(Bell and Buckley, 1912.)

In Aq. KBr Solutions.		In Aq. NaBr Solutions.	
Gms. KBr per Liter.	Gm. Atoms I per Liter.	Gms NaBr per Liter.	Gm Atoms I per Liter.
60.6	0.0176	96.4	0.0266
106.9	0.0278	187.7	0.0425
175.9	0.0415	271.8	0.0538
229.8	0.0532	357.4	0.0598
281.9	0.0628	422.21	0.0638
330.6	0.0717	499.1	0.0648
377.1	0.0797	569.9	0.0644
411	0.0864	632	0.0622
461.7	0.0948	679.7	0.0595
509.8	0.1006	750.5	0.0551
567.9 sat.	0.1094	756.1 sat.	0.0550

Solubility of Iodine in Aqueous Solutions of Acids.

Aqueous Acid.	Mols I per Liter Sat Sol	Gms I per Liter Sat Sol	Authority.
0.001 *n* HCl	0.001332	0.338	(Bray and MacKay, 1910.)
0.10 *n* HNO_3	0.001340	0.340	(Sammet, 1905.)
0.10 *n* H_2SO_4	0.001342	0.341	"

Solubility of Iodine in Aqueous Sodium Iodide Solutions.

(Gill, 1913–14)

Aqueous NaI solutions were prepared by dissolving the stated amounts of the salt in water and diluting to 100 cc. An excess of iodine was added to each of these solutions, the mixtures heated to 60° and shaken for several minutes. They were then allowed to cool in a thermostat at 25° for four hours. The dissolved iodine in weighed amounts of the saturated solutions was titrated with thiosulfate. The densities of the Aq. NaI mixtures and also of the solutions after saturation with iodine were determined.

Gms. NaI per 100 cc. Aq Solution.	d_{25} of Aq NaI Solution.	d_{25} of Aq NaI after Saturation with I.	Gms. I Dissolved at 25° per 100 Gms. of the Sat. Sol.
5	1.0369	1.0698	4.99
10	1.0720	1.1415	9.96
15	1.1072	1.2162	14.93
20	1.1458	1.2998	20.02

Determinations at other temperatures were made in an apparatus which permitted constant stirring of the solutions at the several temperatures. Results, interpolated from the original, are as follows:

t°.	Gms. I Dissolved per 100 Gms. Sat. Solution in Aq NaI of: 10 Gms per 100 cc.	20 Gms. per 100 cc.	t°.	Gms. I Dissolved per 100 Gms. Sat. Solution in Aq NaI of: 10 Gms per 100 cc.	20 Gms. per 100 cc.
10	8.9	17.6	30	10.3	20.5
15	9.3	18.3	40	10.9	22
20	9.6	19	50	11.7	23.4
25	10	19.4	60	12.6	24.9

SOLUBILITY OF IODINE IN AQUEOUS SALT SOLUTIONS AT 25°.

(McLauchlan, 1903.)

Salt.	Gms. Salt per Liter.	Gms. Dissolved I per Liter.	Salt.	Gms. Salt. per Liter.	Gms. Dissolved I per Liter.
Na_2SO_4	29.77	0.160	NH_4Cl	53.4	0.735
K_2SO_4	43.5	0.238	NaBr	103	3.29
$(NH_4)_2SO_4$	33	0.246	KBr	119	3.801
$NaNO_3$	85	0.257	NH_4Br	98	4.003
KNO_3	101.2	0.266	$NH_4C_2H_3O_2$	77.1	0.440
NH_4NO_3	80	0.375	$(NH_4)_2C_2O_4$	86.9	0.980
NaCl	58.5	0.575	H_3BO_3	55.8	0.300
KCl	73.6	0.658			

SOLUBILITY OF IODINE IN NITROBENZENE SOLUTIONS CONTAINING VARIOUS IODIDES AT ROOM TEMPERATURE. SOLUTIONS SAT. WITH I IN EACH CASE.

(Dawson and Goodson, 1904.)

Iodide.	Gms per Liter.		Iodide.	Gms. per Liter.	
	Iodide.	Iodine.		Iodide.	Iodine.
Potassium Iodide	12.35	112.7	Caesium Iodide*	48.2	213
" "	45 56	295 7	Caesium Iodide	223	858
" "	115.8	698.2	Ammonium Iodide	69.5	482
" "	155.2	943.6	Ammonium Iodide*	94.3	669
Sodium Iodide	13 55	125	Aniline Hydriodide	164	721
" "	57.7	393	Dimethylaniline Hydriodide	160	626
" "	109.1	738	Tetramethylammonium Iodide	49 3	266
" "	228	1251	Tetramethylammonium Iodide	51.4	280
Rubidium Iodide	85.4	421	Strontium Iodide	106 5	599
Rubidium Iodide	217.5	1060	Barium Iodide	42 2	237
Lithium Iodide	84.1	642	Barium Iodide	158.5	809

* Solvent = *o* nitrotoluene instead of nitrobenzene.

Similar results are also given for solutions containing KI in addition to the other iodide, and one series for the simultaneous solubility of KBr and I in nitrobenzene. It is considered that the increased solubility is most easily explained on the assumption that periodides are formed in solution.

SOLUBILITY OF IODINE IN AQUEOUS ETHYL AND NORMAL PROPYL ALCOHOL SOLUTIONS AT 15°.

(Bruner, 1898.)

In Aq. Ethyl Alcohol.				In Aq. (n.) Propyl Alcohol.			
Vol. % C_2H_5OH in Solvent.	Gms. I per 100 cc. Solution.	Vol % C_2H_5OH in Solvent.	Gms. I per 100 cc. Solution.	Vol. % C_3H_7OH in Solvent.	Gms. I per 100 cc. Solution.	Vol. % C_3H_7OH in Solvent.	Gms. I per 100 cc. Solution.
10	0.05	60	1.14	10	0.05	60	2.71
20	0.06	70	2.33	20	0.11	70	4.10
30	0.10	80	4.20	30	0.40	80	6.05
40	0.26	90	7.47	40	0.94	90	9.17
50	0.88	100	15.67	50	1.64	100	14.93

SOLUBILITY OF IODINE IN AQUEOUS ETHYL ALCOHOL AND IN AQUEOUS ACETIC ACID SOLUTIONS AT 25°.

(McLauchlan, 1903.)

In Aq. C_2H_5OH Solutions.		In Aq. CH_3COOH Solutions.	
Gms. C_2H_5OH per 100 Gms. Solvent.	Gms. I per 100 cc. Sat. Solution.	Gms. CH_3COOH per 100 Gms. Solvent.	Gms. I per 100 cc Sat. Solution.
0	0.034	0	0.034
4.55	0.039	20	0.076
28.48	0.172	39.5	0.173
44.41	0.955	61.1	0.510
72.51	6.698	80.7	1.363
100	24.548	100	3.162

SOLUBILITY OF IODINE IN AQUEOUS GLYCEROL SOLUTIONS AT 25°.

(Herz and Knoch, 1905.)

Density of glycerine at 25°/4° = 1.2555; impurities about 1.5%.

Wt.% Glycerine in Solvent.	Millimols I per 100 cc. Solution.	Grams I per 100 cc Solution.	Density of Solutions at 25°/4°.
0	0.24	0.0304	0.9979
7.15	0.27	0.0342	1.0198
20.44	0.38	0.0482	1.0471
31.55	0.49	0.0621	1.0750
40.95	0.69	0.0875	1.0995
48.7	1.07	0.135	1.1207
69.2	2.20	0.278	1.1765
100.0	9.70	1.223	1.2646

100 gms. glycerol (d_{15} = 1.256) dissolve 2 gms. iodine at 15°-16°.

(Ossendowski, 1907.)

SOLUBILITY OF IODINE IN BENZENE, CHLOROFORM, AND IN ETHER.

(Arctowski — Z. anorg. Chem. 11, 276, '95-'96.)

In Benzene.		In Chloroform.		In Ether.	
t°.	Gms. I per 100 Gms. Solution.	t°.	Gms. I per 100 Gms. Solution.	t°.	Gms. I per 100 Gms. Solution.
4.7	8.08	−49	0.188	−83	15.39
6.6	8.63	−55½	0.144	−90	14.58
10.5	9.60	−60	0.129	−108	15.09
13.7	10.44	−69½	0.089		
16.3	11.23	−73½	0.080		
		+10	1.76 per 100 gms. $CHCl_3$		

(Duncan — Pharm. J. Trans. 22, 544, '91-'92.)

SOLUBILITY OF IODINE IN BROMOFORM, CARBON TETRACHLORIDE, AND IN CARBON DISULFIDE AT 25°.

(Jakowkin, 1895.)

1 liter of saturated solution in $CHBr_3$ contains 189.55 gms. I.
1 liter of saturated solution in CCl_4 contains 30.33 gms. I.
1 liter of saturated solution in CS_2 contains 230 gms. I.

Solubility of Iodine in Carbon Disulfide.

(Arctowski, 1894.)

t°.	Gms. I per 100 Gms. Solution.	t°.	Gms. I per 100 Gms. Solution.	t°.	Gms. I per 100 Gms. Solution.
−100	0.32	0	7.89	30	19.26
− 80	0.51	10	10.51	36	22.67
− 63	1.26	15	12.35	40	25.22
− 20	4.14	20	14.62	42	26.75
− 10	5.52	25	16.92		

Solubility of Iodine in Several Solvents at 25°.

(Herz and Rathmann, 1913.)

Solvent.	Iodine per Liter of Sat. Sol Mols.	Gms	Solvent.	Iodine per Liter of Sat. Sol. Mols	Gms.
Chloroform	0.352	44.68	Trichlorethylene	0.312	39.61
Carbon Tetrachloride	0.237	30.08	Tetrachlorethane	0.244	30.97
Tetrachlorethylene	0.241	30.59	Pentachlorethane	0.272	34.53

One liter sat. solution of iodine in nitrobenzene contains 50.62 gms. I at 16°–17 (Dawson and Gawler, 190.

100 gms. hexane dissolve 1.32 gms. iodine at 25°. (Hildebrand, Ellefson and Beebe, 191;

100 gms. sat. solution of iodine in anhydrous lanolin (melting point 46°), co tain 5.50 gms. iodine at 45°. (Klose, 190;

Solubility of Iodine in Mixtures of Chloroform and Ether at 25°.

(Marden and Dover, 1916.)

Gms. $CHCl_3$ per 100 Gms. $CHCl_3+(C_2H_5)_2O$.	Gms. Iodine per 100 Gms. $CHCl_3+(C_2H_5)_2O$.	Gms. $CHCl_3$ per 100 Gms. $CHCl_3+(C_2H_5)_2O$.	Gms Iodine per 100 Gm $CHCl_3+(C_2H_5)_2O$.
0	35.1	60	9.83
10	29.6	70	7.5
20	24.8	80	5.73
30	20.2	90	4.31
40	16.3	100	3.10
50	12.7		

100 cc. of a mixture of $CHCl_3 + CS_2$ (3:1) dissolve 7.39 gms. iodine (t° ?. The addition of S even up to the point of saturation does not affect the amoun of iodine held in solution. (Olivari, 1908.

Diagrammatic results for mixtures of iodine and each of the following com pounds are given by Olivari, 1911: CHI_3, *p* $C_6H_4Br_2$, $[C_6H_4]N_2$, *p* $C_6H_4(NO_2)_2$ $(C_6H_5CO)_2O$ and C_6H_5COOH.

Solubility of Iodine in Mixed Solvents at 16.6°.

(Strömholm, 1903.)

Solvent.	Gms. I per Liter Sat Sol.	Solvent.	Gms. I per Liter Sat. Sol.
Ether	206.3	Ether+20.96 gms. CS_2 per liter	202.3
Carbon Disulfide	178.5	Ether+41.9 " CS_2 "	217.2
Ether+3.96 gms. H_2O per liter	221	CS_2 +22.5 " ether "	189.3
" +7.91 gms. H_2O "	235 7	CS_2 +45.1 " ether "	201.1
" +excess H_2O	251.4	Ether+47.63 " $CHCl_3$ "	195.2
" +9.79 gms. C_2H_5OH "	219.1	CS_2 +50.06 " $CHCl_3$ "	172.8
" +19.6 " " "	231.5	Ether+80.3 " C_6H_6 "	204.1
" +29.4 " " "	243.9	Ether+77.85 " CH_3I "	220.2
" +39.2 " " "	254.4	CS_2 +62.2 " S "	189.4

One liter sat. solution in ether contains 167.3 gms. I at 0°. (Strömholm, 1903.)

SOLUBILITY OF IODINE IN MIXTURES OF CHLOROFORM AND ETHYL ALCOHOL, CHLOROFORM AND NORMAL PROPYL ALCOHOL, CHLOROFORM AND BENZENE, AND CHLOROFORM AND CARBON DISULFIDE AT 15°.

(Bruner, 1898.)

Vol. % $CHCl_3$ in Solvent.	Gms. I Dissolved per 100 cc. of Mixtures of:			
	$CHCl_3+C_2H_5OH$.	$CHCl_3+C_3H_7OH$.	$CHCl_3+C_6H_6$.	$CHCl_3+CS_2$.
0	15.67	14.93	10.40	17.63
10	9.43	13.16	9.84	15.93
20	8.69	11.20	8.78	14.20
30	7.80	8.98	7.74	12.16
40	7.09	8.09	6.96	10.20
50	6.62	7.82	6.20	9.08
60	6.24	7.09	5.34	7.72
70	5.77	6.42	4.89	6.42
80	5.06	5.54	4.53	5.27
90	4.34	4.52	4.07	4.32
100	3.62	3.62	3.62	3.62

SOLUBILITY OF IODINE IN MIXTURES OF CARBON TETRACHLORIDE AND BENZENE AND IN MIXTURES OF CARBON TETRACHLORIDE AND CARBON DISULFIDE AT 15°.

(Bruner, 1898.)

Vol. % CCl_4 in Solvent.	Gms. I per 100 cc of Mixture of:		Vol. % CCl_4 in Solvent.	Gms. I per 100 cc. of Mixture of:	
	$CCl_4+C_6H_6$.	CCl_4+CS_2.		$CCl_4+C_6H_6$.	CCl_4+CS_2.
0	10.40	17.6	60	4.90	5.55
10	9.44	14.44	70	4.09	4.50
20	8.53	12.33	80	3.41	3.37
30	7.77	10.34	90	2.74	2.60
40	6.63	8.60	100	2.06	2.06
50	5.70	6.83			

In the case of the above determinations the volume change occurring on mixing the solvents was neglected. The temperature was not accurately regulated and the mixtures not shaken during the saturation. The curves plotted from the results are not smooth.

DISTRIBUTION OF IODINE BETWEEN WATER AND BROMOFORM, WATER AND CARBON DISULFIDE, AND WATER AND CARBON TETRACHLORIDE AT 25°.

(Jakowkin, 1895.)

The original results were plotted on cross-section paper and the following table made from the curves. Jakowkin points out that the results of Berthelot and Jungfleisch, 1872, are incorrect on account of the presence of HI.

Gms. I per Liter of H_2O Layer in Each Case.	Gms. I per Liter of:		
	$CHBr_3$ Layer.	CS_2 Layer.	CCl_4 Layer.
0.05	20	30	4
0.10	45	60	8.5
0.15	71	91	13
0.20	100	126	17.5
0.25	130	160	22

A theoretical discussion of the results of Jakowkin is given by Schükarew (1901).

DISTRIBUTION OF IODINE BETWEEN CARBON DISULFIDE AND AQ. POTASSIUM OXALATE.

(Dawson — Z. physik. Chem. 56, 610, '06; Dawson and McRae — J. Chem. Soc. 81, 1086, '02.)

Concentration of Aq. $K_2C_2O_4$.	Gms. I per Liter of Aq. Layer.	Gms. I per Liter of CS_2 Layer.	Vol. of Solution which Contains 1 Mol. I.	Fraction of I Uncombined in Solution.
1.0 Equiv.	2.408	10.82	105.3	0.005495
1.0 "	3.555	16.32	71.37	0.00561
1.0 "	5.766	27.91	43.99	0.005915
1.0 "	6.861	34.01	36.98	0.006055
1.2 "	3.525	17.07	71.97	0.005645

DISTRIBUTION OF IODINE BETWEEN AMYL ALCOHOL AND WATER AND BETWEEN AMYL ALCOHOL AND AQUEOUS POTASSIUM IODIDE SOLUTIONS AT 25°.

(Herz and Fischer — Ber. 37, 4752, '04)

The original results were plotted on cross-section paper, and the following tables made from the curves.

Millimols I per 10 cc Amyl Alcohol Layer in Each Case.	Millimols I per 10 cc. of H_2O and of Aq. KI Layers. H_2O.	$\frac{N}{10}$ KI.	$\frac{2N}{10}$ KI.	$\frac{3N}{10}$ KI.	$\frac{4N}{10}$ KI.	$\frac{10N}{10}$ KI.
2.5	0.012	0.135	0.160	0.170	0.170	...
3.0	0.014	0.150	0.185	0.200	0.200	0.160
4.0	0.018	0.180	0.235	0.255	0.270	0.240
5	0.021	0.210	0.280	0.315	0.340	0.315
6	0.025	0.230	0.330	0.375	0.410	0.390
7	0.029	0.250	0.375	0.430	0.480	0.470
8	...	0.260	0.420	0.490	0.550	0.555
9	...	0.270	0.450	0.550	0.620	0.640
10	...	0.280	0.470	0.605	0.690	0.720
12	...	...	0.490	0.700	0.830	0.900
14	...	...	0.510	0.790	0.980	1.200
20	...	...	0.575	...	...	...

Gms. I per 100 cc. Amyl Alcohol Layer in Each Case.	Gms. I per 100 cc. of H_2O and of KI Layers. H_2O.	$\frac{N}{10}$ KI.	$\frac{2N}{10}$ KI.	$\frac{3N}{10}$ KI.	$\frac{4N}{10}$ KI.	$\frac{10N}{10}$ KI.
3	0.014	0.164	0.20	0.21	0.21	...
4	0.016	0.196	0.24	0.26	0.26	0.21
6	0.026	0.252	0.34	0.38	0.40	0.37
8	0.033	0.297	0.43	0.49	0.54	0.51
10	0.040	0.328	0.51	0.61	0.67	0.69
12	...	0.341	0.58	0.73	0.81	0.84
14	...	...	0.60	0.83	0.95	1.00
16	...	...	0.63	0.91	1.09	1.20
18	...	...	0.64	...	...	...
25	...	...	0.71	...	...	...

The original figures for 5N/10 and 10N/10 KI solutions give practically identical curves.

Results for the distribution of Iodine between N/10 KI solutions on the one hand, and mixtures in various proportions of $C_6H_6 + CS_2$, $C_6H_5CH_3 + CS_2$, $C_6H_6 + C_6H_5CH_3$, C_6H_6 + light petroleum, CS_2 + light petroleum, $CS_2 + CHCl_3$, $CHCl_3 + C_6H_6$, $CCl_4 + CS_2$ and $CCl_4 + C_6H_5CH_3$ on the other hand, are given by Dawson — J. Chem. Soc., **81**, 1086, '02.

Distribution of Iodine between Water and Immiscible Organic Solvents.

Results for Water + Carbontetrachloride at 18°. (Dawson, 1908.)

Mols. Iodine per Liter.	
H_2O Layer.	CCl_4 Layer.
0.000416	0.0344
0.000535	0.0443

Results for Water + Nitrobenzene at 18°. (Dawson, 1908.)

Mols. Iodine per Liter.	
H_2O Layer.	$C_6H_5NO_2$ Layer.
0.00019	0.0333
0.00050	0.0854
0.00133	0.2275
0.00189	0.3328

Results for Water + Carbon Disulfide at 15°. (Dawson, 1902.)

Gms. Iodine per Liter.	
H_2O Layer.	CS_2 Layer.
0.0452	27.85
0.0486	30.09
0.0486	30.31

Results for Water + Chloroform at 25°. (Herz & Kurzer, 1910.)

Mols. Iodine per Liter.	
H_2O Layer.	$CHCl_3$ Layer.
0.00025	0.0338
0.00120	0.1546
0.00184	0.2318
0.00259	0.3439

Results for Water + Trichlorethylene at 25°. (Herz & Rathmann, '13.)

Mols. Iodine per Liter.	
H_2O Layer.	$CHCl.CCl_2$ Layer.
0.00046	0.0543
0.00070	0.0778
0.00112	0.1275
0.00236	0.2672

Results for Water + Tetrachlorethylene at 25°. (Herz & Rathmann, '13.)

Mols. Iodine per Liter.	
H_2O Layer.	$CCl_2.CCl_2$ Layer.
0.00088	0.0653
0.00127	0.0932
0.00172	0.1285
0.00281	0.2161

Results for Water + Tetrachlorethane at 25°. (Herz & Rathmann, '13.)

Mols. Iodine per Liter.	
H_2O Layer.	$C_2H_2Cl_4$ Layer.
0.00119	0.1101
0.00145	0.1247
0.00159	0.1479
0.00217	0.2103

Results for Water + Pentachlorethane at 25°. (Herz & Rathmann, '13.)

Mols. Iodine per Liter.	
H_2O Layer.	C_2HCl_5 Layer.
0.00092	0.0848
0.00117	0.1067
0.00160	0.1434
0.00204	0.1963

Data for the distribution of iodine between water and mixtures of CS_2+CCl_4 at 25° are given by Herz and Kurzer, 1910.

Data for the distribution of iodine between carbon disulfide and aqueous solutions of each of the following iodides at 25° are given by van Name and Brown, 1917. Cadmium iodide, cadmium potassium iodide, lanthanum iodide, nickel iodide, strontium iodide, zinc iodide and zinc potassium iodide. Results for the distribution of iodine between carbon tetrachloride and aq. mercuric potassium iodide are also given.

Results for distribution between CS_2 and aq. BaI_2 sols. are given by Herz and Kurzer, 1910.

Data for the distribution of iodine between carbon disulfide and aqueous solutions of potassium iodide at 15° and at 13.5°, and between carbon disulfide and aqueous solutions of hydriodic acid at 13.5°, are given by Dawson, 1901 and 1902.

Data for the distribution of iodine between carbon tetrachloride and aqueous solutions of mercuric bromide and of mercuric chloride at 25° are given by Herz and Paul, 1914.

Distribution of Iodine between Carbon Disulfide and Aq. Ethyl Alcohol at 25°. (Osaka, 1903–08)

Gms. C_2H_5OH per 100 cc. Aq. Alcohol.	Gms Iodine per Liter: CS_2 Layer c.	Aq Alcohol Layer c'.	$\frac{c}{c'}$.	Gms. C_2H_5OH per 100 cc. Aq. Alcohol.	Gms Iodine per Liter: CS_2 Layer c.	Aq Alcohol Layer c'.	$\frac{c}{c'}$.
7.6	0.072	35.86	0.0020	19.1	0.330	97	0.0034
7.6	0.211	107.79	0.0020	22.9	0.115	23.78	0.0048
11.4	0.077	32.93	0.0023	22.9	0.418	89.61	0.0047
11.4	0.280	133.22	0.0021	26.7	0.0756	9.8	0.0077
15.3	0.075	25.61	0.0029	26.7	0.495	65.10	0.0076
15.3	0.315	115.34	0.0027	30.5	0.0636	4.90	0.0130
19.1	0.045	13.42	0.0034	30.5	0.546	42.27	0.0129

Distribution of Iodine between Ether and Ethylene Glycol. (Landau, 1910.)

Results at 0°. Gms. Iodine per Liter: $(C_2H_5)_2O$ Layer (a).	$(CH_2OH)_2$ Layer (b).	$\frac{a}{b}$.	Results at 25°. Gms. Iodine per Liter: $(C_2H_5)_2O$ Layer (a).	$(CH_2OH)_2$ Layer (b).	$\frac{a}{b}$.
2.139	1.449	1.48	2.208	1.449	1.52
7.820	4.347	1.80	4.255	2.541	1.60
16.620	9.486	1.75	7.728	4.347	1.78
20.564	11.685	1.76	16.200	9.120	1.78
31.785	18.135	1.75	30.322	17.062	1.78
79.950	44.460	1.80	78.195	44.460	1.76

DISTRIBUTION OF IODINE BETWEEN GLYCEROL AND BENZENE AND BETWEEN GLYCEROL AND CARBON TETRACHLORIDE.

(Landau, 1910)

Results for Glycerol and Benzene.

t°.	Grams Iodine per Liter: Glycerol Layer. (a)	Benzene Layer. (b)	$\frac{(b)}{(a)}$.
25°	0.407	1.922	4.72
"	0.676	4.086	6.04
"	1.470	10.212	6.95
"	2.622	20.102	7.67
"	5.280	42.458	8.04
40°	0.459	2.168	4.72
"	0.658	3.911	5.94
"	1.584	11.244	7.10
"	3.048	24.104	7.91
"	5.564	46.960	8.44
50°	0.467	2.194	4.70
"	0.642	3.864	6.02
"	1.463	11.196	7.65
"	2.391	19.872	8.31
"	5.383	46.782	8.69

Results for Glycerol and CCl_4.

t°.	Gms. Iodine per Liter: Glycerol Layer. (a)	CCl_4 Layer. (b)	$\frac{(b)}{(a)}$.
25°	0.365	0.565	1.55
"	0.684	1.224	1.78
"	1.416	2.652	1.87
"	5.064	9.888	1.95
"	7.636	14.766	1.93
40°	0.322	0.575	1.79
"	0.690	1.169	1.74
"	1.224	2.772	1.69
"	2.832	6.444	2.26
"	6.854	15.410	2.25
50°	0.299	0.653	2.19
"	0.570	1.270	2.23
"	1.511	3.457	2.29
"	2.664	6.468	2.43
"	6.348	16.008	2.52

DISTRIBUTION OF IODINE BETWEEN GLYCEROL AND CHLOROFORM.

Results at 25°. (Herz & Kurzer, 1910)

Mols. Iodine per 1000 Gms. Glycerol Layer c.	$CHCl_3$ Layer c'.	$\frac{c}{c'}$.
0.0244	0.0564	0.43
0.0397	0.0919	0.43
0.0500	0.1151	0.43

Results at 30°. (Hantzsch & Vagt, 1901.)

Mols. Iodine per Liter: Glycerol Layer c.	$CHCl_3$ Layer c'.	$\frac{c}{c'}$.
0.00097	0.00172	0.056
0.00204	0.00412	0.495
0.00418	0.00898	0.465
0.00782	0.0216	0.362

Results at Dif. Temps. (Hantzsch & Vagt, 1901.)

t°.	Mols. I per Liter: Glycerol Layer c.	$CHCl_3$ Layer c'.	$\frac{c}{c'}$.
0	0.0119	0.0177	0.675
20	0.0084	0.0213	0.400
40	0.0077	0.0221	0.349
50	0.0074	0.0226	0.330

Data are also given by the above named investigators for the distribution of iodine between aqueous glycerol solutions and chloroform at several temperatures.

DISTRIBUTION OF IODINE BETWEEN GLYCEROL AND ETHYL ETHER.

(Hantzsch & Vagt, 1901)

t°.	Mols. Iodine per Liter: Glycerol Layer (c).	Ether Layer (c').	$\frac{c}{c'}$.
0	0.00566	0.0270	0.21
30	0.00544	0.0272	0.20
30	0.00100	0.0051	0.20

FREEZING-POINT DATA (Solubility, see footnote, p. 1) FOR MIXTURES OF IODINE AND OTHER ELEMENTS.

Iodine and Selenium	(Pellini and Pedrina, 1908.)
" " Sulfur	(Olivari, 1908; Smith and Carson, 1908.)
" " Tellurium	(Jaeger and Menke, 1912.)
" " Tin	(van Klooster, 1912–13; Remders and de Lange, 1912–13.)

SOLUBILITY OF IODINE IN ARSENIC TRICHLORIDE. (Sloan and Mallet, 1882.)

t°.	0°.	15°.	96°.
Gms. I per 100 gms. $AsCl_3$	8.42	11.88	36.89

IODOEOSIN (Sodium tetra iodofluorescein) $C_{20}H_6I_4O_5Na_2$.

100 gms. H_2O dissolve 90 gms. iodoeosin at 20–25°. (Dehn, 1917.)
100 gms. pyridine dissolve 4.63 gms. iodoeosin at 20–25°. "
100 gms. aq. 50% pyridine dissolve 71.6 gms. iodoeosin at 20–25°. "

IODOFORM CHI_3, **IODOL** C_4I_4NH (Tetraiodopyrrol).

SOLUBILITY IN SEVERAL SOLVENTS.
(U. S. P. VIII; Vulpius, 1893.)

Solvent.	t°.	Gms. per 100 Gms. Solvent. CH_3I.	C_4I_4NH.
Water	25	0.0106	0.0204
Alcohol	25	2.14 (1.43 gms. (V.))	11.1
Alcohol	b. pt.	(10 gms. (V.))	...
Ether	25	19.2 (16.6 gms. (V.))	66.6
Chloroform	25	...	0.95
Pyridine	20–25	173.1 (Dehn, 1917.)	
Aq. 50% pyridine	20–25	22.4 "	
Lanolin (30% H_2O)	46	5.2 (Klose, 1907.)	

IRIDIUM CHLORIDE $IrCl_4$.

When 1 gm. iridium as chloride is dissolved in 100 cc. of 10% HCl and shaken at 18° with 100 cc. of ether, 0.02 per cent of the metal enters the ethereal layer. When 20% HCl is used 5% of the metal enters the ether. When dissolved in 1% HCl or in water approximately 0.01 per cent of the metal enters the ethereal layer. (Mylius, 1911.)

IRIDIUM Ammonium **CHLORIDE** $IrCl_4.2NH_4Cl$.

SOLUBILITY IN WATER.
(Rimbach and Korten, 1907.)

t°.	Gms. $IrCl_4.2NH_4Cl$ per 100 Gms. Water.	Sat. Sol.	t°.	Gms. $IrCl_4.2NH_4Cl$ per 100 Gms. Water.	Sat. Sol.
14.4	0.699	0.694	52.2	1.608	1.583
26.8	0.905	0.899	61.2	2.130	2.068
39.4	1.226	1.124	69.3	2.824	2.746

IRIDIUM DOUBLE SALTS.

SOLUBILITY IN WATER.
(Palmaer — Ber. 23, 3817; 24, 2090, '91.)

Double Salt.	Formula.	t°.	Gms. per 100 Gms H_2O.
Irido Pentamine Bromide	$Ir(NH_3)_5Br_3$	12.5	0.284
" " Bromonitrate	$Ir(NH_3)_5Br(NO_3)_2$	18	5.58
" " Tri Chloride	$Ir(NH_3)_5Cl_3$	15.1	6.53
" " Chloro Bromide	$Ir(NH_3)_5ClBr_2$	15	0.47
" " Chloro Iodide	$Ir(NH_3)_5ClI_2$	15	0.95
" " Chloro Nitrate	$Ir(NH_3)_5Cl(NO_3)_2$	15.4	1.94
" " Chloro Sulphate	$Ir(NH_3)_5ClSO_4.2H_2O$	15.0	0.74
" " Nitrate	$Ir(NH_3)_5(NO_3)_3$	16	0.28
" Aquo Pentamine Bromide	$Ir(NH_3)_5(OH_2)Br_3$	ord. temp.	25.0
" " " Chloride	$Ir(NH_3)_5(OH_2)Cl_3$	ord. temp.	74.7
" " " Nitrate	$Ir(NH_3)_5(OH_2)(NO_3)_3$	17	10.0

IRON BROMIDE (Ferrous) $FeBr_2.6H_2O$.

SOLUBILITY IN WATER.
(Etard — Ann. chim. phys. [7] 2, 537, '94.)

t°.	Gms. $FeBr_2$ per 100 Gms. Sol.	t°.	Gms. $FeBr_2$ per 100 Gms. Sol.	t°.	Gms. $FeBr_2$ per 100 Gms. Sol.
−20	47.0	30	55.0	60	59.0
0	50.5	40	56.2	80	61.5
20	53.5			100	64.0

IRON CARBONATE (Ferrous) $FeCO_3$.

SOLUBILITY OF FERROUS CARBONATE IN AQUEOUS SALT SOLUTIONS, BOTH WITH AND WITHOUT THE PRESENCE OF CARBON DIOXIDE.
(Ehlert and Hempel, 1912.)

(Each mixture was 1000 cc. in volume and was rotated constantly for 24 hours. Temp., probably 5-8°.)

Aqueous Solution of:	Solubility in Presence of CO_2 (2 atmospheres pressure).		Solubility in Absence of CO_2.	
	Gms. Salt per 1000 Gms. H_2O.	Gms $FeCO_3$ per 1000 cc. Solvent.	Gms. Salt per 1000 Gms. H_2O.	Gms. $FeCO_3$ per 1000 cc. Solvent.
Water alone	0	6.191	...	...
NaCl	...	...	351.2	0.350
$MgCl_2.6H_2O$	86.9	5.840	...	...
"	700	4.555	...	...
"	1150	4.459	...	...
"	1437.5	4.693	...	...
"	1725	5.398	...	...
"	2300	9.052	2300	4.205
$Na_2SO_4.10H_2O$	137.7	7.943	137.7	0.701
"	Sat. at 14°	9.578	Sat. at 14°	0.934
$MgSO_4.7H_2O$	105.3	6.242	105.3	1.467
"	Sat. at 14°	7.392	Sat. at 14°	2.933

IRON BICARBONATE (Ferrous) $Fe(HCO_3)_2$.

SOLUBILITY OF FERROUS BICARBONATE IN CARBONATED WATER AT 30°.
(Smith, H. J, 1918)

Pure white ferrous carbonate was prepared by heating to 100° for several days in a steel bottle, an aqueous solution of ferrous sulfate, sodium bicarbonate and carbon dioxide (introduced at 400 lbs. pressure). The crystalline product was similar to the mineral siderite and was probably isomorphous with calcite. Fifty to one hundred gram portions were placed in a two-liter steel bottle, coated on the inside with a mixture of beeswax and Venice turpentine. Water was added and CO_2 introduced through a needle valve from a cylinder of the liquefied gas. The pressure was read on a gauge. The bottle was rotated at constant temperature for several days or until equilibrium was reached. The portion of the saturated solution for analysis was withdrawn through a brass tube attached to the valve on the inside of the bottle and packed with cotton to act as a filter. The filtered portion was received in a tared evacuated flask, containing a few cc. of conc. H_2SO_4. The CO_2 was determined by absorption and the iron by precipitation, resolution, reduction and titration with permanganate. The results show that the decomposition tension of $Fe(HCO_3)_2$ is greater than 25 atmospheres at 25°.

Gms. Mols. per Liter.		Gms per Liter.		Gms Mols per Liter.		Gms. per Liter.	
H_2CO_3.	$Fe(HCO_3)_2$.	H_2CO_3.	$Fe(HCO_3)_2$.	H_2CO_3.	$Fe(HCO_3)_2$.	H_2CO_3.	$Fe(HCO_3)_2$.
0.1868	0.00245	11.58	0.436	0.3294	0.00311	20.43	0.553
0.1985	0.00256	12.31	0.455	0.3745	0.00315	23.23	0.560
0.2168	0.00262	13.45	0.466	0.4046	0.00332	25.09	0.590
0.2327	0.00274	14.43	0.487	0.4750	0.00348	29.45	0.619
0.2960	0.00303	18.35	0.539	0.6600	0.00402	40.93	0.715
0.3116	0.00304	19.32	0.541	0.7154	0.00418	44.36	0.744
0.3153	0.00318	19.55	0.566	0.7600	0.00434	47.13	0.772

IRON CHLORIDE (Ferrous) $FeCl_2.4H_2O$.

100 gms. sat. sol. in water contain 17.54 gms. Fe = 39.82 gms. $FeCl_2$ at 22.8°.
100 gms. sat. sol. in water contain 18.59 gms. Fe = 42.8 gms. $FeCl_2$ at 43.2°.
(Boecke, 1911.)

IRON CHLORIDE (Ferrous) $FeCl_2.4H_2O$. Solubility in Water.

(Etard.)

t°.	Gms. $FeCl_2$ per 100 Gms. Solution.	Solid Phase.	t°.	Gms. $FeCl_2$ per 100 Gms. Solution.	Solid Phase.
10	39.2	$FeCl_2.4H_2O$	60	47.0	$FeCl_2.4H_2O$
15	40.0	"	80	50.0	"
25	41.5	"	87	51.2	$FeCl_2.4H_2O + FeCl_2$
30	42.2	"	90	51.3	$FeCl_2$
40	43.6	"	100	51.4	"
50	45.2	"	120	51.8	"

Solubility of Iron Chloride (Ferric) Fe_2Cl_6 in Water.

(Roozeboom — Z. physik. Chem. 10, 477, '92.)

t°.	Mols. Fe_2Cl_6 per 100 Mols. H_2O.	Gms. $FeCl_3$ per 100 Gms. H_2O.	Gms. $FeCl_3$ per 100 Gms. Solution.
Solid Phase, $Fe_2Cl_6.12H_2O$.			
−55	2.75	49.52	33.12
−27	2.98	53.60	34.93
0	4.13	74.39	42.66
+20	5.10	91.85	47.88
30	5.93	106.8	51.64
37	8.33	150.0	60.01
30	11.20	201.7	66.85
20	12.83	231.1	69.79
8	13.7	246.7	71.15
Solid Phase, $Fe_2Cl_6.7H_2O$.			
20	11.35	204.4	67.14
32	13.55	244.0	70.92
30	15.12	272.4	73.13
25	15.54	280.0	73.69
Solid Phase, $Fe_2Cl_6.5H_2O$.			
12	12.87	231.8	69.87
27	14.85	267.5	72.78
Solid Phase, $Fe_2Cl_6.5H_2O$ (con.).			
35	15.64	281.6	73.79
50	17.50	315.2	75.91
55	19.15	344.8	77.52
55	20.32	365.9	78.54
Solid Phase, $Fe_2Cl_6.4H_2O$.			
50	19.96	359.3	78.23
55	20.32	365.9	78.54
60	20.70	372.8	78.86
69	21.53	387.7	79.50
73.5	25.0	450.2	81 81
70	27.9	502.4	83 41
66	29.2	525.9	84.03
Solid Phase, Fe_2Cl_6.			
66	29.2	525.9	84.03
75	28.92	511.4	83.66
80	29.20	525.9	84.03
100	29.75	535.8	84.26

Solubility of Ferric Chloride in Aqueous Solutions of Ammonium Chloride at 25°, 35°, and 45°.

(Mohr — Z. physik. Chem. 27, 197, '98.)

Results at 25°. Mols. per 100 Mols. H_2O.		Results at 35°. Mols. per 100 Mols. H_2O.		Results at 45°. Mols. per 100 Mols. H_2O.		Solid Phase in Each Case.
NH_4Cl.	$FeCl_3$.	NH_4Cl.	$FeCl_3$.	NH_4Cl.	$FeCl_3$.	
0	10.98	0	13.36	0.0	33.4	$Fe_2Cl_6.12H_2O$ ($5.H_2O$ at 45°)
1.57	10.74	1.41	13.05	...	...	Hydrate + Double Salt
2.48	9.02	3.08	9.28	4.08	9.58	Double Salt
5.28	7.73	6.98	7.64	...	...	"
9.59	6.77	10.76	6.70	13.09	6.31	"
9.83	6.70	11.60	6.52	13.54	6.28	Double Salt + Mixed Crystals
9.65	6.07	12.28	6.08	12.91	5.49	Mixed Crystals
9.93	5.23	11.57	3.98	13.49	4.84	"
9.92	3.97	11.89	3.38	13.46	4.99	"
10.31	2.05	13.23	1.38	...	...	"
13.30	0.0	14.79	0.0	16.28	0.0	NH_4Cl

SOLUBILITY OF FERRIC CHLORIDE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AT 15°.

(Roozeboom — Z. physik. Ch. 10, 148, '92.)

Mols. per 100 Mols. H_2O. NH_4Cl.	Mols. per 100 Mols. H_2O. $FeCl_3$.	Grams per 100 Gms. H_2O. NH_4Cl.	Grams per 100 Gms. H_2O. $FeCl_3$.	Solid Phase.
0.0	9.30	0.0	83.88	$Fe_2Cl_6.12H_2O$
1.09	9.57	3.24	86.32	"
1.36	9.93	4.03	91.61	$Fe_2Cl_6.12H_2O$ + Double Salt
2.00	9.27	5.92	83.64	Double Salt
2.79	8.71	8.31	78.77	"
4.05	8.09	12.08	73.20	"
6.41	7.18	19.12	64.83	"
10.78	6.21	32.04	56.00	"
7.82	6.75	23.21	60.83	Mixed Crystals containing 7.29% $FeCl_3$
7.62	5.94	22.63	53.47	" " 5.55 "
7.70	5.03	22.90	45.42	" " 4.4 "
7.81	4.34	23.23	39.13	" " 3.8 "
8.52	2.82	25.33	25.43	" " 1.64 "
10.95	0.68	32.55	6.15	" " 0.31 "
11.88	0.0	35.30	0.0	NH_4Cl

SOLUBILITY OF FERRIC CHLORIDE IN AQUEOUS HYDROCHLORIC ACID SOLUTIONS AT DIFFERENT TEMPERATURES.

(Roozeboom and Schreinemaker — Z. physik. Chem. 15, 633, '94.)

Mols. per 100 Mols. H_2O. HCl.	Mols. per 100 Mols. H_2O. $FeCl_3$	Gms. per 100 Gms. H_2O. HCl.	Gms. per 100 Gms. H_2O. $FeCl_3$.	Solid Phase.
Results at 0°.				
0	8.25	0	74.30	$Fe_2Cl_6.12H_2O$
7.52	6.51	15.22	58.62	"
13.37	6.33	27.06	57.01	"
16.80	8.70	33.99	78.34	"
18.45	10.23	37.34	92.10	"
20.40	15.40	41.28	138.7	"
20.10	16.00	40.67	144.1	"
19.95	17.70	40.37	159.4	"
19.00	22.75	38.45	204.8	"
18.05	23.41	36.53	210.8	"
18.05	23.40	36.53	210.8	$Fe_2Cl_6.7H_2O$
19.50	25.93	39.55	233.5	"
24.12	30.04	48.81	270.5	$Fe_2Cl_6.5H_2O$
26.00	32.16	52.60	289.6	"
26.00	32.16	52.60	289.6	$Fe_2Cl_6.4H_2O$
34.60	38.11	70.01	343.2	"
37.27	36.60	75.41	329.6	$Fe_2Cl_6.2HCl + 4H_2O$
34.60	38.11	70.01	343.2	"
Results at 25°.				
0.0	10.90	0.0	98.15	$Fe_2Cl_6.12H_2O$
2.33	23.72	4.715	213.6	"
0.0	24.5	0.0	220.7	"
0.0	23.5	0.0	211.6	$Fe_2Cl_6.7H_2O$
2.33	23.72	4.715	213.4	"
7.50	29.75	15.18	267.9	"
0.0	31.50	0.0	283.6	"

Mols. per 100 Mols. H_2O. HCl.	Mols. per 100 Mols. H_2O. $FeCl_3$.	Gms. per 100 Gms. H_2O. HCl.	Gms. per 100 Gms. H_2O. $FeCl_3$.	Solid Phase
Results at 25° (con.).				
0.0	29.00	0.0	261.1	$Fe_2Cl_6.5H_2O$
7.5	29.75	15.18	267.9	"
19.5	35.25	39.46	317.4	"
19.5	35.25	39.46	317.4	$Fe_2Cl_6.4H_2O$
20.6	35.34	41.68	318.3	"
31.34	41.58	63.42	374.4	"
33.00	43.00	66.77	387.3	"
34.65	44.80	70.11	403.4	"
40.41	40.25	81.77	362.4	$Fe_2Cl_6.2HCl + 4H_2O$
39.03	41.38	78.98	372.7	"
35.74	45.24	72.33	407.4	"
Results at 40°.				
0	32.4	0.0	291.7	$Fe_2Cl_6.5H_2O$
13.4	37.45	27.11	337.3	"
13.4	37.45	27.11	337.3	$Fe_2Cl_6.4H_2O$
27.0	50.80	54.64	457.5	"
0	58.0	0.0	522.3	Fe_2Cl_6
27	50.8	54.64	457.5	"
42.01	48.64	85.00	438.0	"
42.50	47.52	86.72	428.0	$Fe_2Cl_6.2HCl + 4H_2O$
42.01	48.64	85.00	438.0	"

Results for other temperatures are also given in the original paper.

RESULTS FOR THE SYSTEM FERRIC OXIDE, HYDROCHLORIC ACID, WATER AT 25°.
(Cameron and Robinson, 1907.)

(Excess of ferric hydroxide was added to aq. ferric chloride solutions and agitated for 3 months.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
Fe_2O_3.	HCl.			Fe_2O_3.	HCl.	
34.61	59.88	$FeCl_3.HCl.2H_2O$	1.485	21.84	29.33	$FeCl_3.6H_2O+Fe_2O_3.xHCl.H_2O$
33.27	60.23	"	1.349	16.82	22.55	$Fe_2O_3.xHCl.H_2O$
32.78	54.71	" $+FeCl_3$	1.321	15.83	21.10	"
31.95	58.20	$FeCl_3+FeCl_3.2H_2O$	1.284	14.62	19.53	"
34.42	54.12	$FeCl_3.2H_2O$	1.242	12.59	16.61	"
35.22	59.28	"	1.220	11.76	15.28	"
34.07	55.71	"	1.195	10.56	13.76	"
34.21	55.47	" $+FeCl_3.2\frac{1}{2}H_2O$	1.158	8.60	11.24	"
34.44	51.11	$FeCl_3.3\frac{1}{2}H_2O+$ "	1.115	6.47	8.39	"
33.04	46.72	" $+FeCl_3.6H_2O$	1.070	4.04	5.36	"
24.42	33.40	$FeCl_3.6H_2O$	1.047	2.85	3.66	"

Data for the systems $FeCl_2 + MgCl_2 + KCl + H_2O$ at 22.8° and for $FeCl_3 + KCl + NaCl$ are given by Boeke, 1911.

100 gms. abs. acetone dissolve 62.9 gms. $FeCl_3$ at 18°. (Naumann, 1904.)

100 gms. anhydrous lanolin (m. pt. about 46°) dissolve 4.17 gms. $FeCl_3$ at 45°. (Klose, 1907.)

DISTRIBUTION OF FERRIC CHLORIDE BETWEEN WATER AND ETHER AT 18°.
(Mylius, 1911.)

One-gram portions of iron as chloride were dissolved in 100 cc. of aq. HCl of different concentrations and shaken with 100 cc. of ether in each case. The percentage of iron in the ethereal layer was determined after separation of the two layers.

Per cent conc. of Aq. HCl	1	5	10	15	20
Per cent of Iron Extracted by Ether	(0.01)	0.1	8	92	99

Fusion-point curves (solubility, see footnote, p. 1) for mixtures of $FeCl_3 + PbCl_2$ and $FeCl_3 + ZnCl_2$ are given by Herrmann, 1911, and for mixtures of $FeCl_3+TlCl$ by Scarpa, 1912.

SOLUBILITY OF THE SALT PAIR $FeCl_3.NaCl$ IN WATER AT 21°.
(Hinrichsen and Sachsel, 1904–05.)

Gms. Used.		Gms. per 100 Gms. Solution		G. Mols. per 100 Mols. H_2O.		Solid Phase.
$FeCl_3$.	NaCl.	$FeCl_3$.	NaCl.	$FeCl_3$.	NaCl.	
0	3.6	0	36.10	0	11.2	NaCl
1.8	3	24.27	9.10	2.69	2.8	Mix Crystals
3.6	2.5	25.40	8.45	2.81	2.6	"
5.5	2	26.40	5.25	2.93	2.54	"
7.2	1.5	38.15	3.90	4.23	1.22	"
9	1	45.38	2.45	5.03	0.75	"
10.8	0.5	46.75	2.11	5.18	0.65	"
10.8	0	83.39	0	9.3	0	$FeCl_3$

SOLUBILITY OF THE SALT PAIR $FeCl_3.KCl$ IN WATER AT 21°.

(Hinrichsen and Sachsel, 1904-05.)

Gms. Used.		Gms. per 100 Gms. Solution.		Gms. Mols. per 100 Mols. H_2O.		Solid Phase.
$FeCl_3$.	KCl.	$FeCl_3$.	KCl.	$FeCl_3$.	KCl.	
0	35	0	34.97	0	8.45	KCl
13	28	13.44	24.45	1.49	5.90	Mix Crystals
18	21	23.18	16.54	2.57	3.99	"
23	18.5	28.05	11.69	3.11	2.82	"
28	16	35.72	11.68	3.96	2.82	"
31	10.5	36.62	11.19	4.06	2.70	$FeCl_3.2KCl.H_2O$
36.2	9	37.35	13.67	4.14	3.30	"
46.5	6	51.69	7.54	5.73	1.82	"
155	0	83.89	0	9.3	0	$FeCl_3$

SOLUBILITY OF THE SALT PAIR $FeCl_3.CsCl$ IN WATER AT 21°.

(H. and S.)

Gms. Used.		Gms. per 100 Gms. Solution		Gms. Mols. per 100 Mols H_2O.		Solid Phase.
$FeCl_3$.	CsCl.	$FeCl_3$	CsCl.	$FeCl_3$.	CsCl.	
0	65	0	65	0	6.95	CsCl
0.6	11.6	0.45	55.18	0.05	5.9	$FeCl_3.3CsCl.H_2O$
1.4	10.2	2.1	52.38	0.23	5.6	"
2.2	8.8	5.24	51.44	0.57	5.5	"
2	7.4	7.8	47.70	0.86	5.1	$FeCl_3.2CsCl\ H_2O$
3.8	6	8.93	41.15	0.99	4.4	"
4.6	4.6	15.34	25.25	1.70	2.7	"
5.4	2.8	21.65	14.96	2.40	1.6	"
6.2	1.4	27.96	8.42	3.10	0.9	"
35	0.2	48.71	0.94	5.40	0.1	"
35	0	83.89	0	9.3	0	$FeCl_3$

IRON FORMATE (Ferric) $Fe_3(OH)_2(HCOO)_7.4H_2O$.

SOLUBILITY IN WATER AND IN ABSOLUTE ALCOHOL.

(Hampshire and Pratt, 1913.)

Solubility in Water.

t°.	Gms. Salt per 100 Gms. H_2O.	Solid Phase.
15	5.08	$Fe_3(OH)_2(HCOO)_7.4H_2O$
20	5.52	"
25	6.10	"
30	6.78	"
35	7.52	"

Solubility in Abs. Alcohol.

t°.	Gms. Salt per 100 Gms. C_2H_5OH.
19	4.59
22	6.25
23	7.62

(The sat. solutions are not stable.)

IRON HYDROXIDE (Ferric) $Fe(OH)_3$.

SOLUBILITY OF FERRIC HYDROXIDE IN AQ. OXALIC ACID SOLUTION AT 25°.
(Cameron and Robinson, 1909)

The solutions were constantly agitated for 3 months. The solubility is directly proportional to the concentration of the oxalic acid and no definite basic ferric oxalate is formed.

d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol. Fe_2O_3.	C_2O_3.	d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol. Fe_2O_3.	C_2O_3.
1.007	0.48	0.61	1.040	2.33	3.10
1.015	0.95	1.23	1.050	2.98	3.85
1.031	1.86	2.45	1.064	3.62	5.17

IRON NITRATE (Ferric) $Fe(NO_3)_3.9H_2O$.

EQUILIBRIUM IN THE SYSTEM, FERRIC OXIDE, NITRIC ACID AND WATER AT 25°.
(Cameron and Robinson, 1909)

Solutions of ferric nitrate of varying concentrations were shaken with freshly precipitated ferric hydroxide at const. temp., 25°, for 4 months. The acid branch of the curve was studied in a similar manner by starting with ferric nitrate and various concentrations of nitric acid. No definite basic nitrates of iron were formed.

d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol. Fe_2O_3	N_2O_5	Solid Phase.	d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol. Fe_2O_3	N_2O_5.	Solid Phase.
1.032	1.78	2.21	$Fe_2O_3.mN_2O_5.nH_2O$	1.452	12.14	33.5	$Fe_2O_3.3N_2O_5.18H_2O$
1.079	3.99	5.61	"	1.434	9.95	36.3	"
1.127	5.79	9	"	1.417	7.25	40.3	"
1.177	7.22	12.31	"	1.404	5.02	47.5	"
1.264	9.70	16.60	"	1.428	3.55	51.5	"
1.368	12.48	22.70	"	1.450	4.51	52	"
1.435	14.62	28.13	"	1.465	4.19	55.2	"
1.498	15.40	29.52	"	1.407	3.93	47.2	$Fe_2O_3.4N_2O_5.18H_2O$*
1.496	15.22	30.50	$Fe_2O_3.3N_2O_5.18H_2O$	1.419	3.52	49.6	"

* This salt was obtained accidentally and its preparation could not be repeated.

IRON NITRATE (Ferrous) $Fe(NO_3)_2.6H_2O$.

SOLUBILITY IN WATER.
(Funk, 1900.)

t°.	Gms. $Fe(NO_3)_2$ per 100 Gms. Sol.	Mols. $Fe(NO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Fe(NO_3)_2$ per 100 Gms. Sol.	Mols. $Fe(NO_3)_2$ per 100 Mols H_2O	Solid Phase.
−27	35.66	5.54	$Fe(NO_3)_2.9H_2O$	−9	39.68	6.57	$Fe(NO_3)_2.6H_2O$
−21.5	36.10	5.64	"	0	41.53	7.10	"
−19	36.56	5.76	"	18	45.14	8.23	"
−15.5	37.17	5.91	"	24	46.51	8.70	"
				60.5	62.50	16.67	"

Density of solution saturated at 18° = 1.497.

IRON OXALATE (Ferrous) $FeC_2O_4.2H_2O$.

SOLUBILITY IN WATER AT 25° DETERMINED BY THE CONDUCTIVITY METHOD.
(Schäfer, 1905.)

The sat. solution contains $5.38.10^{-4}$ gm. mols. C_2O_4 per liter.

IRON OLEATE.

100 gms. glycerol (d = 1.114) dissolve 0.71 gm. iron oleate. (Asselin, 1873.)

IRON OXIDES, HYDROXIDE and **SULPHIDE.**

SOLUBILITY IN AQUEOUS SUGAR SOLUTIONS.
(Stelle — Z. Ver Zuckerind. 50, 340, '00.)

% Sugar in Solvent.	One Liter of Sugar Solutions Dissolves Milligrams of: $Fe_2(OH)_6$ at:			Fe_2O_3 at:		Fe_3O_4 at:			FeS at:		
	17.4°.	45°.	75°.	17.5°.	45°.	17.5°.	45°.	75°.	17.5°.	45°.	75°.
10	3.4	3.4	6.1	1.4	2.0	10.3	10.3	12.4	3.8	3.8	5.3
30	2.3	2.7	3.8	1.4	...	12.4	10.3	12.4	7.1	9.1	7.2
50	2.3	1.9	3.4	0.8	1.1	14.5	10.3	14.5	9.9	19.8	9.1

IRON PHOSPHATE $Fe_2(PO_4)_3$.

THE ACTION OF WATER AND OF AQUEOUS SALT SOLUTIONS UPON FERRIC PHOSPHATE.
(Lachowicz — Monatsh. Chem. 13, 357, '92; Cameron and Hurst — J. Am. Chem. Soc. 26, 888, '04.)

The experiments show that the ordinary precipitation methods for the production of ferric phosphate give products which do not conform to the formula $Fe_2(PO_4)_3$. By digesting such samples with water very little is dissolved, but the material is decomposed to an extent depending upon the relative amounts of solid and solvent used. The amount of PO_4 dissolved per gram of $Fe_2(PO_4)_3$ varies from about 0.0026 gram removed by 5 cc. H_2O to 0.0182 gram removed by 800 cc. H_2O at the ordinary temperature.

SOLUBILITY FERRIC PYROPHOSPHATE IN AQ. AMMONIA AT 0°. (Pascal, 1909)

The solutions containing an excess of salt were agitated violently every half hour for seven hours and filtered at 0°. The sat. sol. was analyzed for ammonia and for residue obtained by evaporation.

Gms. NH_3 per 100 Gms. Sat. Sol.	Gms $Fe_4(P_2O_7)_3$ per 100 Gms. Sat Sol	Solid Phase.	Gms. NH_3 per 100 Gms. Sat. Sol.	Gms. $Fe_4(P_2O_7)_3$. per 100 Gms. Sat. Sol.	Solid Phase.
0.884	5.606	$Fe_4(P_2O_7)_3$	5.92	14.71	viscous black deposit
1.59	9.75	"	8.26	13.89	chamois colored lumps
3.71	14.85	"	10.55	7.40	"
4.72	15.94	"	15.96	2.52	"
5.93	13.92	viscous black deposit	18.83	0.445	"
7.91	14.61	"			

SOLUBILITY OF FERRIC PHOSPHATE IN AQ. PHOSPHORIC ACID SOLUTIONS AT 25°.
(Cameron and Bell, 1907)

Solid ferric phosphate of unknown composition was constantly agitated with aq. phosphoric acid solutions of concentrations up to 5% for 4 months. Analyses of the sat. solutions and solid phases were made.

d_{25} of Sat. Sol.	Gms per 100 Gms Sat. Sol. Fe_2O_3.	P_2O_5.	Solid Phase.
1.0074	0.0105	0.942	Solid Solution
1.0162	0.0205	1.984	"
1.0244	0.0384	2.838	"
1.0310	0.0611	3.770	"
1.0383	0.0849	4.706	"

IRON SULFATE (Ferrous) $FeSO_4.7H_2O$.

SOLUBILITY OF FERROUS SULFATE IN WATER. (Fraenckel, 1907.)

t°.	Gms. $FeSO_4$ per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. $FeSO_4$ per 100 Gms. H_2O.	Solid Phase.
−0.172	1.0156	Ice	45.18	44.32	$FeSO_4.7H_2O$
−0.566	4.2852	"	50.21	48.60	"
−1.063	8.7054	"	52	50.20	"
−1.511	12.713	"	54.03	52.07	"
−1.771	14.511	"	56.56 tr. pt.	54.58	" $+FeSO_4.4H_2O$
−1.82 Eutec.	17.53	Ice$+FeSO_4.7H_2O$	60.01	54.95	$FeSO_4.4H_2O$
0	15.65	$FeSO_4.7H_2O$	65	55.59	" unstable
+10	20.51	"	70.04	56.08	" "
15.25	23.86	"	64.8 tr. pt.	...	$FeSO_4.4H_2O+FeSO_4.H_2O$
20.13	26.56	"	68.02	52.31	$FeSO_4.H_2O$
25.02	29.60	"	77	45.90	"
30.03	32.93	"	80.41	43.58	"
35.07	36.87	"	85.02	40.46	"
40.05	40.20	"	90.13	37.27	"

$d_{16.6}$ of sat. sol. = 1.219. (Greenish and Smith, 1903)

SOLUBILITY OF FERROUS SULFATE IN AQ. SOLUTIONS OF LITHIUM SULFATE AT 30°. AND VICE VERSA. (Schreinemakers, 1910)

Gms. per 100 Gms. Sat. Sol. $FeSO_4$.	Li_2SO_4.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. $FeSO_4$.	Li_2SO_4.	Solid Phase.
24.87	0	$FeSO_4.7H_2O$	15.39	16.80	$Li_2SO_4.H_2O$
24.45	4	"	12.68	18.31	"
21.15	5.58	"	5.32	22.15	"
18.79	11.16	"	3.74	23.15	"
16.51	15.81	"	0	25.1	"
16.11	16.50	" $+Li_2SO_4.H_2O$			

EQUILIBRIUM IN THE SYSTEM FERRIC OXIDE, SULFURIC ACID AND WATER AT 25°. (Cameron and Robinson, 1907)

(Excess of freshly precipitated ferric hydroxide was added to ferric sulfate solutions of varying concentrations and the mixtures constantly shaken for 4 months.)

d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol. Fe_2O_3.	SO_3.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. Fe_2O_3	SO_3	Solid Phase.
1.001	0.07	0.11	Solid Solution	20.48	26.18	$Fe_2O_3.3SO_3.10H_2O$
1.011	0.62	0.94	"	19.77	28.93	"
1.045	2.03	2.65	"	10.87	31.35	$Fe_2O_3.4SO_3 10H_2O$
1.131	6.18	7.40	"	0.16	35.96	"
1.217	10.03	11.84	"	0.07	41.19	"
1.440	15.90	20.70	"	1.05	42.43	"

SOLUBILITY OF FERRIC SULFATE AND OF FERROUS SULFATE IN AQ. SOLUTIONS OF SULFURIC ACID AT 25°. (Wirth, 1912-13)

Results for Ferric Sulfate.

Normality of used Acid.	Gms. per 100 Gms Sat. Sol Fe_2O_3	= $Fe_2(SO_4)_3$.
2.25	9.99	25.02
6.685	5.82	14.58
19.84	0.02	0.05

Results for Ferrous Sulfate.

Normality of used Acid.	Gms. per 100 Gms Sat. Sol FeO	= $FeSO_4$.	Solid Phase.
2.25	10	19.03	$FeSO_4.7H_2O$
10.2	5.414	10.30	"
12.46	3.816	7.26	$FeSO_4.H_2O$
15.15	2.11	4.015	"
19.84	0.08	0.1522	"

Equilibrium in the System Ferric Oxide–Sulfur Trioxide–Water at 25°.

(Wirth and Bakke, 1914.)

(The mixtures were shaken for 3–4 weeks.)

Gms. per 100 Gms. Sat. Sol. Fe_2O_3.	SO_3.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. Fe_2O_3.	SO_3.	Solid Phase.
...	71.23	not det.	14.49	31.45	unstable
0.24	56.84	"	15.71	31.88	"
3.53	34	prob. $Fe_2(SO_4)_3.H_2SO_4.9H_2O$ $+Fe_2(SO_4)_3.H_2SO_4.3H_2O$	20.21	31.30	"
6.65	32.15	$Fe_2(SO_4)_3.H_2SO_4.8H_2O$	9.39	31.54	$Fe_2(SO_4)_3.H_2SO_4.8H_2O+$ $Fe_2(SO_4)_3.9H_2O$
9.39	31.54	" $+Fe(SO_4)_3.H_2SO_4.3H_2O$	11.06	29.43	$Fe_2(SO_4)_3.9H_2O$
12.03	31.51	$Fe(SO_4)_3.H_2SO_4.8H_2O$	13.88	28.33	"
13.27	31.84	"	15.23	27.92	"
13.68	31.78	unstable	16.07	27.98	"

Results are also given for the two forms of yellow ferric sulfate (α copiapite and β copiapite) also for ferric hydroxide and sulfate solutions.

It was found that a saturated solution of $Fe_2(SO_4)_3.H_2SO_4.8H_2O$ in abs. alcohol at 25° contained 8 gms. Fe_2O_3 + 17.18 gms. SO_3 (Ratio, 1:4.235) per 100 gms. sat. sol.

The yellow ferric sulfate $Fe_2(SO_4)_3.9H_2O$ is less soluble in alcohol. After 4 weeks shaking at 25°, 100 gms. of the sat. solution in abs. alcohol contained 4.497 gms. Fe_2O_3 and 6.779 gms. SO_3 (Ratio, 1:3.006). Thus the alcoholic solution, just as the aqueous, is considerably more acid than the solid phase with which it is in equilibrium.

100 grams sat. solution in glycol contain 6 gms. $FeSO_4$ at ordinary temperature. (de Coninck.)

100 gms. anhydrous hydrazine dissolve 1 gm. ferrous sulfate at room temp. with decomposition. (Welsh and Broderson, 1915.)

Solubility of Mixtures of Ferrous Sulphate $FeSO_4.7H_2O$ and Sodium Sulphate $Na_2SO_4.10H_2O$ in Water.

(Koppel — Z. physik. Chem. 52, 405, '05.)

t°.	Gms. per 100 Gms. Solution. $FeSO_4$.	Na_2SO_4.	Gms. per 100 Gms. H_2O. $FeSO_4$.	Na_2SO_4.	Solid Phase.
0	14.54	4.93	18.06	6.11	$FeSO_4.7H_2O + Na_2SO_4.10H_2O$
15.5	17.76	11.32	25.05	15.97	" "
21.8	16.57	15.32	24.34	22.51	$FeNa_2(SO_4)_2.4H_2O$
24.92	16.21	15.13	23.62	22.04	"
35	16.35	14.98	23.91	21.83	"
40	16.37	15.42	24.01	22.62	"
18.8	18.13	13.8	26.63	20.28	$FeNa_2(SO_4)_2.4H_2O + FeSO_4.7H_2O$
23	19.58	12.5	28.82	18.4	" "
27	20.97	11.3	30.95	16.64	" "
31	22.91	9.71	33.99	14.41	" "
35	23.85	9.26	35.66	13.85	" "
40	26.32	7.85	39.98	11.92	" "
18.8	18.23	14.83	27.23	22.16	$FeNa_2(SO_4)_2.4H_2O + Na_2SO_4.10H_2O$
23	13.83	18.04	20.31	26.48	" "
28	7.66	24.41	11.28	35.94	" "
31	4.58	29.50	6.95	44.75	" "
35	4.04	30.49	6.16	46.58	$FeNa_2SO_4.4H_2O + Na_2SO_4$
40	4.10	30.60	6.27	46.99	" "

IRON Potassium **SULFATE** (Ferrous) $FeSO_4.K_2SO_4.6H_2O$.

SOLUBILITY IN WATER. (Tobler, 1855.)

t°.	Gms. $K_2Fe(SO_4)_2$ per 100 Gms. H_2O.	t°.	Gms. $K_2Fe(SO_4)_2$ per 100 Gms. H_2O.
0	19.6	35	41
10	24.5	40	45
14.5	29.1	55	56
16	30.9	65	57.3
25	36.5	70	64.2

IRON SULFIDE (Ferrous) FeS.

One liter of water, saturated at 18° with precipitated ferrous sulfide, contains $70.1.10^{-6}$ mols. FeS = 0.00616 gm., determined by conductivity method. (Weigel, 1906, 1907.)

Additional data for the solubility in water are given by Bruner and Zawadzki.

100 gms. anhydrous hydrazine dissolve 9 gms. FeS at room temp. with decomposition. (Welsh and Broderson, 1915.)

Fusion diagrams for mixtures of FeS + PbS and for FeS + ZnS are given by Friedrich, 1907, 1908.

IRON SULFONATES.

SOLUBILITY OF IRON PHENANTHRENE SULFONATES IN WATER AT 20°. (Sandquist, 1912.)

Salt.	Gms. Anhydrous Salt per 100 Gms H_2O.
Iron 2-Phenanthrene Monosulfonate $5H_2O$	0.044
" 3- " " $5H_2O$	0.20
" 10- " " $6H_2O$	0.16

IRON THIOCYANATE (Ferric) $Fe(CNS)_3.3H_2O$.

DISTRIBUTION BETWEEN WATER AND ETHER. (Hantzsch and Vagt, 1901.)

Results at 25°.

Gm. Mols. $Fe(CNS)_3$ per Liter. H_2O Layer (c)	Ether Layer (c').	$\frac{c}{c'}$.
0.0202	0.0108	1.87
0.0119	0.0034	3.51
0.0066	0.00093	7.07
0.0035	0.00025	13.95

Results at Several Temperatures.

t°.	Gm Mols $Fe(CNS)_3$ per Liter. H_2O Layer (c).	Ether Layer (c').	$\frac{c}{c'}$.
0	0.0089	0.0167	0.532
10	0.0127	0.0128	0.995
20	0.0165	0.0091	1.814
30	0.0196	0.0059	3.303
35	0.0207	0.0048	4.32

Results for the effect of HNO_3 upon the distribution at 25° are also given.

ITACONIC ACID $CH_2:C(COOH)CH_2COOH$.

Data for the distribution of itaconic acid between water and ether at 25° are given by Chandler, 1908.

KERATIN.

100 gms. H_2O dissolve 8.71 gms. keratin at 20–25°. (Dehn, 1917.)
100 gms. aq. 50% pyridine dissolve 16 gms. keratin at 20–25°. "
Pyridine mixes with keratin in all proportions at 20–25°. "

KRYPTON Kr. SOLUBILITY IN WATER. (von Antropoff, 1909–10.)

(Results in terms of coefficient of absorption as defined by Bunsen, see p. 227, and modified by Kuenen in respect to substituting mass for volume of water involved.)

t°.	Abs. Coef (First Series).	Abs. Coef. (Second Series).
0	0.1249	0.1166
10	0.0965	0.0877
20	0.0788	0.0670
30	0.0762	0.0597
40	0.0740	0.0561
50	0.0823	0.0610

The cause of the differences between the first and second series of results was not ascertained by the author.

LACTIC ACID (*i*) $CH_3CHOHCOOH$.

DISTRIBUTION BETWEEN WATER AND ETHER.
(Pinnow, 1915.)

Results at 15°. Gm. Mols. Acid per Liter: H_2O Layer (*w*).	Ether Layer (*e*).	$\frac{w}{e}$.	Results at 27.5°. Gm. Mols. Acid per Liter: H_2O Layer (*w*).	Ether Layer (*e*).	$\frac{(w)}{(e)}$.
1.98	0.215	9.19	1.354	0.130	10.42
1.351	0.133	10.15	0.3203	0.0278	11.52
0.297	0.0246	12.08	0.1855	0.0156	11.89
0.1448	0.0118	12.27			
0.0548	0.0046	11.88			

F.-pt. data for mixtures of trichlorolactic acid and dimethylpyrone are given by Kendall, 1914.

LACTOSE (see sugars, pages 695–7).

LANTHANUM BROMATE $La(BrO_3)_3.9H_2O$.

100 gms. H_2O dissolve 28.5 gms. lanthanum bromate at 15°. (Marignac.)

LANTHANUM CITRATE $2(LaC_6H_5O_7).7H_2O$.

100 gms. aq. citric solution containing 10 gms. citric acid per 100 cc., dissolve 0.8 gm. $La(C_6H_5O_7)$ at 20°. (Holmberg, 1907.)

LANTHANUM Cobalti**CYANIDE** $La_2(CoC_6N_6)_2.9H_2O$.

100 gms. aq. 10% HCl (d_{15} = 1.05) dissolve 10.41 gms. salt at 25°. (James and Willand, 1916.)

LANTHANUM GLYCOLATE $La(C_2H_3O_3)_3$.

One liter H_2O dissolves 3.328 gms. $La(C_2H_3O_3)_3$ at 20°. (Jantsch and Grunkraut, 1912–13.)

LANTHANUM IODATE $La(IO_3)_3$.

SOLUBILITY IN WATER AND IN AQ. SALT SOLUTIONS AT 25°.
(Harkins and Pearce, 1916)

1000 gms. H_2O dissolve 0.6842 gm. $La(IO_3)_3$ at 25°, $d_{\frac{25}{4}}$ sat. sol. = 0.99825.

Salt.	Conc. of Salt, Milli-Normal.	Gms. $Li(IO_3)_3$ per Liter.	$d_{\frac{25}{4}}$ of Sat. Sol.	Salt.	Conc. of Salt, Milli-Normal.	Gms. $Li(IO_3)_3$ per Liter.	$d_{\frac{25}{4}}$ of Sat. Sol.
$La(NO_3)_3$	2	0.5595	0.99732	$NaNO_3$	25	0 86901	1.00250
"	5	0.5288	0.99807	"	50	0 99040	1.00385
"	10	0.5194	0 99859	"	100	1.1603	1 00742
"	50	0.5522	1.00212	"	200	1 385	1.01290
"	100	0.6214	1.00661	"	400	1.636	1.02422
"	200.52	0.7431	1.01533	"	800	2.156	1.04677
KIO_3	0.0990	0.6290	1.00030	"	1600	2.859	1.09005
"	0.4957	0 5633	1.00027	"	3200	3 030	1.17243
"	0.9914	0.4970	1.00030	$La(NO_3)_3.$-$2NH_4NO_3$	26.34	0.631	1.00112
"	1.9828	0.3738	1.00031				
$NaIO_3$	0.0913	0.63538	1.00060	"	52.68	0.674	1.00355
"	0.4560	0.56466	1.00059	"	105.36	0 754	1.00971
"	0.9130	0.50835	1.00065	"	158.04	0.816	1.01608
"	1.8260	0.39938	1.00065	"	196.83	0.867	1.02183
"	3.6530	0.19736	1.00069	"	393.67	1.063	1.04343
"	4.5326	0.13393	1.00083	"	787.35	1.364	1.08286
"	6.7989	0.09733	1.00130	"	1574.70	1.923	1.16652

According to Rimbach and Schubert (1909), one liter H_2O dissolves 1.681 gms. $Li(IO_3)_3$ at 25°, determined chemically, and 1.871 gms. determined electrolytically; solid phase, $2La(IO_3)_3.3H_2O$.

LANTHANUM MALONATE $La_2(C_3H_2O_4)_3.5H_2O$.

100 gms. aq. Am. malonate sol. (10 gms. per 100 cc.) dissolve 0.2 gm. $La_2(C_3H_2O_4)_3$ at 20°.
100 gms. aq. malonic acid sol. (20 gms. per 100 cc.) dissolve 0.6 gm. $La_2(C_3H_2O_4)_3$ at 20°. (Holmberg, 1907.)

LANTHANUM MOLYBDATE $La_2(MoO_4)_3$.

One liter H_2O dissolves 0.0179 gm. $La_2(MoO_4)_3$ at 25° and 0.0332 gm. at 85°. (Hitchcock, 1895.)

LANTHANUM Ammonium **NITRATE** $La(NO_3)_3.2NH_4NO_3$.

100 gms. H_2O dissolve 181.4 gms. $La(NO_3)_3.2NH_4NO_3$ at 15°. (Holmberg, 1907.)

LANTHANUM Double **NITRATES.**

SOLUBILITY OF LANTHANUM DOUBLE NITRATES IN CONC. HNO_3 (d_{16} = 1.325) AT 16°. (Jantsch, 1912.)

Salt.	Formula.	Gms Hydrated Salt Dissolved per Liter Sat. Sol
Lanthanum Magnesium Nitrate	$[La(NO_3)_6]_2Mg_3.24H_2O$	63.8
" Nickel "	" Ni_3 "	80.3
" Cobalt "	" Co_3 "	109.2
" Zinc "	" Zn_3 "	124.1
" Manganese "	" Mn_3 "	193.1

LANTHANUM NITRATE $La(NO_3)_3$.

SOLUBILITY OF LANTHANUM NITRATE IN AQUEOUS SOLUTIONS OF LANTHANUM OXALATE AT 25° AND VICE VERSA. (James and Whittemore, 1912.)

Gms. per 100 Gms. Sat. Sol. $La_2(C_2O_4)_3$.	$La(NO_3)_3$	Solid Phase.	Gms. per 100 Gms. Sat. Sol. $La_2(C_2O_4)_3$	$La(NO_3)_3$.	Solid Phase.
0	60.17	$La(NO_3)_3$	not det.	not det.	$La_2(C_2O_4)_3.5H_2O$
0.67	59.91	"	3.32	42.27	$La_2(C_2O_4)_3.8H_2O$
2.10	59.03	"	2.80	38.50	"
2.23	59.03	" $+La_2(C_2O_4)_3.3H_2O$	2.51	35.57	"
2.26	58.22	$La_2(C_2O_4)_3.3H_2O$	2.21	31.53	"
2.34	55.20	"	2.01	28.63	"
2.47	52.74	"	1.46	22.15	"
2.59	49.84	"	1.18	17.99	"
2.68	45.26	"	0.50	9.89	"
not det.	not det.	$La_2(C_2O_4)_3.5H_2O$	0.28	5.06	"

LANTHANUM OXALATE $La_2(C_2O_4)_3.9H_2O$.

One liter water dissolves 0.00062 gm. $La_2(C_2O_4)_3$ at 25°, determined by electrolytic method. (Rimbach and Schubert, 1909.)

100 gms. aq. 10.2% HNO_3 (d = 1.063) dissolve 0.80 gm. $La_2(C_2O_4)_3$ at 15°. (v. Scheele, 1899.)

100 gms. aq. 19.4% HNO_3 (d = 1.116) dissolve 2.69 gms. $La_2(C_2O_4)_3$ at 15°. (v. Scheele, 1899.)

SOLUBILITY OF LANTHANUM OXALATE IN AQ. SOLUTIONS OF SULFURIC ACID AT 25°. (Hauser and Wirth, 1908; Wirth, 1908; Wirth, 1912.)

Normality of H_2SO_4.	Gms. per 100 Gms. Sat. Sol. La_2O_3	= $La_2(C_2O_4)_3$.	Solid Phase.	Normality of H_2SO_4.	Gms. per 100 Gms. Sat. Sol. La_2O_3	= $La_2(C_2O_4)_3$.	Solid Phase.
0.1	0.0208	0.0346	$La_2(C_2O_4)_3.9H_2O$	2	0.4417	0.7344	$La_2(C_2O_4)_3.9H_2O$
0.5	0.0979	0.1629	"	3.09	0.680	1.1306	"
1	0.2383	0.3962	"	4.32	0.880	1.4630	"
1.5	0.319	0.5304	"	5.6	1.092	1.8155	"

SOLUBILITY OF LANTHANUM OXALATE IN AQ. SOLUTIONS OF OXALIC ACID AT 25°. (Hauser and Wirth, 1908.)

Normality of Aq. Oxalic Acid.	Gms. per 100 Gms. Sat. Sol. La_2O_3	= $La_2(C_2O_4)_3$.	Solid Phase.
0.1	unweighable		$La_2(C_2O_4)_3.9H_2O$
1.0	0.00032	0.00053	"
3.2 (sat.)	0.00045	0.00075	"

Results are also given for the solubility in mixtures of sulfuric and oxalic acids.

100 cc. aq. 20% triethylamineoxalate dissolve approx. 0.032 gm. $La_2(C_2O_4)_3$. (Grant and James, 1917.)

LANTHANUM Dimethyl **PHOSPHATE** $La_2[(CH_3)_2PO_4]_6.4H_2O$.

100 gms. H_2O dissolve 103.7 gms. $La_2[(CH_3)_2PO_4]_6$ at 25°. (Morgan and James, 1914.)

LANTHANUM SULFATE $La_2(SO_4)_3.9H_2O$.

SOLUBILITY IN WATER. (Muthmann and Rölig, 1898.)

t°.	Gms. $La_2(SO_4)_3$ per 100 Gms. Solution.	Water.	t°.	Gms. $La_2(SO_4)_3$ per 100 Gms. Solution.	Water.
0	2.91	3	50	1.47	1.5
14	2.53	2.6	75	0.95	0.96
30	1.86	1.9	100	0.68	0.69

SOLUBILITY OF LANTHANUM SULFATE IN AQ. SOLUTIONS OF AMMONIUM SULFATE, POTASSIUM SULFATE AND SODIUM SULFATE. (Barre, 1910, 1911.)

In Aq. $(NH_4)_2SO_4$ at 18°. Gms. per 100 Gms H_2O. $(NH_4)_2SO_4$.	$La_2(SO_4)_3$.	Solid Phase.	In Aq. K_2SO_4 at 16.5°. Gms per 100 Gms. H_2O. K_2SO_4.	$La_2(SO_4)_3$.	Solid Phase.	In Aq. Na_2SO_4 at 18°. Gms. per 100 Gms. H_2O. Na_2SO_4.	$La_2(SO_4)_3$.	Solid Phase.
4.01	0.393	1.1.2	0	2.198	1.0.9	0	2.130	1.0.9
8.73	0.279	"	0.247	0.727	1.1.2	0.395	0.997	1.1.2
18.24	0.253	"	0.496	0.269	"	0.689	0.353	"
27.89	0.476*	"	0.846	0.185	"	0.774	0.299	"
36.11	0.277*	"	1.029	0.054	1.5	1.136	0.129	"
47.49	0.137	2.5	1.156	0.022	"	2.480	0.044	"
53.82	0.067	1.5				3.802	0.019	"
65.29	0.0117	"				5.548	0.016	"
73.78	0.0033	"						

* = unstable equilibrium.

1.0.9 = $La_2(SO_4)_3.9H_2O$, 1.1.2 = $La_2(SO_4)_3.X_2SO_4.2H_2O$ (where X = (NH_4), K or Na), 2.5 = $2La_2(SO_4)_3.5(NH_4)_2SO_4$, 1.5 = $La_2(SO_4)_3.5X_2SO_4$.

SOLUBILITY OF LANTHANUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°. (Wirth, 1912.)

Normality of Aq. H_2SO_4.	Gms. per 100 Gms. Sat. Sol. La_2O_3	= $La_2(SO_4)_3$.	Solid Phase.	Normality of Aq. H_2SO_4.	Gms. per 100 Gms. Sat. Sol. La_2O_3	= $La_2(SO_4)_3$.	Solid Phase.
Water	1.43	2.483	$La_2(SO_4)_3.9H_2O$	4.321	1.11	1.927	$La_2(SO_4)_3.9H_2O$
0.505	1.69	2.934	"	6.685	0.531	0.9217	"
1.10	1.796	3.118	"	9.68	0.266	0.4617	"
2.16	1.818	3.156	"	12.60	0.214	0.371	"
3.39	1.42	2.465	"	15.15	0.177	0.307	"

Data for the solubility of lanthanum sulfate in aq. H_2SO_4 in presence of solid oxalic acid at 25° are given by Wirth, 1908.

LANTHANUM SULFONATES.

SOLUBILITY OF EACH IN WATER.

Sulfonate.	Formula.	Gms. Anhydrous Sulfonate per 100 Gms. H_2O.	Authority.
Lanthanum Benzene Sulfonate	$La[C_6H_5SO_3]_3.9H_2O$	63.1	(Holmberg, 1907.)
" *m* Nitrobenzene Sulfonate	$La[C_6H_4NO_2SO_3]_3.6H_2O$	16	"
" *m* Chlorbenzene Sulfonate	$La[C_6H_4Cl.SO_3]_3.9H_2O$	13.1	"
" *m* Brombenzene "	$La[C_6H_4Br.SO_3]_3.9H_2O$	12.9	"
" (6) Chloro (3) Nitrobenzene (1) Sulfonate	$La[C_6H_3Cl(NO_2)SO_3]_3.8H_2O$	24.5	"
" (1) Bromo (4) Nitrobenzene (2) Sulfonate	$La[C_6H_3BrNO_2SO_3]_3.8H_2O$	5	(Katz & James, '13.)
" α Naphthalene Sulfonate	$La[C_{10}H_7SO_3]_3.6H_2O$	5.2	(Holmberg, 1907.)
" 1.5 Nitronaphthalene Sulfonate	$La[C_{10}H_6(NO_2)SO_3]_3.6H_2O$	0.55	"
" 1.6 " "	" $.9H_2O$	0.21	"
" 1.7 " "	" $.9H_2O$	1.1	"

LANTHANUM TARTRATE $La_2(C_4H_4O_6)_3.9H_2O$.

One liter H_2O dissolves 0.059 gm. $La_2(C_4O_4O_6)_3$ at 25° (solid phase $La_2(C_4H_4O_6)_3.3H_2O$). Determined by electrolytic method. (Rimbach and Schubert, 1909.)

SOLUBILITY OF LANTHANUM TARTRATE IN AQ. TARTARIC ACID AND AMMONIUM TARTRATE SOLUTIONS AT 20°.
(Holmberg, 1907.)

In Aq. Tartaric Acid.		In Aq. Ammonium Tartrate.	
Gms. Tartaric Acid per 100 cc. Solvent.	Gms. $La_2(C_4O_4O_6)_3$ per 100 Gms. Sat. Sol.	Gms. Am. Tartrate per 100 cc. Solvent.	Gms. $La_2(C_4H_4O_6)_3$ per 100 Gms Sat. Sol.
20	0.6	10	0.2
40	1.2	20	0.6

LANTHANUM TUNGSTATE $La_2(WO_4)_3$.

One liter H_2O dissolves 0.0117 gm. $La_2(WO_4)_3$ at 27° and 0.0236 at 65°. (Hitchcock, 1895.)

LAURIC ACID $C_{11}H_{23}COOH$.

SOLUBILITY IN ALCOHOLS.
(Timofeiew, 1894.)

Alcohol.	t°.	Gms $C_{11}H_{23}COOH$ per 100 Gms Sat. Sol.	Alcohol.	t°.	Gms. $C_{11}H_{23}COOH$ per 100 Gms. Sat. Sol.
Methyl Alcohol	0	14.8	Propyl Alcohol	0	21.5
"	21	58.6	"	21	52.6
Ethyl Alcohol	0	20.5	Isobutyl Alcohol	0	18.4
"	21	57.3	"	21	49.7

LEAD Pb.

An extensive investigation of the solubility of lead in the water passing through lead pipes is described by Paul, Ohlmüller, Heise and Auerbach, 1906. The solubility is increased by oxygen, CO_2, sulfates and perhaps other salts; it is decreased by hydrocarbonates.

SOLUBILITY OF LEAD IN LIQUID AMMONIA-SODIUM SOLUTIONS AT −33°.
(Smith, F H, 1917)

Gm. Atoms Sodium per Liter of Liquid Ammonia.	Gm Atoms Pb Dissolved per Gm. Atom Na.	Gm Atoms Na per Liter of Liquid Ammonia.	Gm. Atoms Pb Dissolved per Gm. Atom Na.
0.078	1.95	0.13	2.17
0.093	2.20	0.14	2.12
0.094	2.03	0.33	1.83
0.110	2.24	0.34	1.73
0.12	1.78		

LEAD ACETATE $Pb(C_2H_3O_2)_2.3H_2O$.

100 gms. H_2O dissolve 55.04 gms. $Pb(C_2H_3O_2)_2$ at 25°. (Jackson, 1914.)

EQUILIBRIUM IN THE SYSTEM LEAD OXIDE, ACETIC ACID, WATER AT 25°.
(Sakabe, 1914)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat Sol.		Solid Phase.
PbO.	CH_3COOH.		PbO.	CH_3COOH.	
4.18	21.53	$Pb(C_2H_3O_2)_2.3H_2O$	7.15	7.26	$(C_2H_3O_2)(HO)Pb + (C_2H_3O_2)_2Pb.2(HO)_2Pb$
3.80	16.78	"			
3.16	13.07	"	5.20	5.61	$(C_2H_3O_2)_2Pb.2(HO)_2Pb$
2.64	5.49	"	3.78	4.17	"
3.34	5.36	"	2.89	2.51	"
4.38	7.30	"	1.45	1.03	"
5.18	7.92	" $+(C_2H_3O_2)(HO)Pb$	1.05	0.54	PbO
5.59	7.72	$(C_2H_3O_2)(HO)Pb$	1.07	0.48	"
6.51	7.79	"	1	0.20	"

Equilibrium was attained quickly in the acid solutions but 2–3 days were required in case of the basic salts. Both sat. solutions and solid phases were analyzed.

EQUILIBRIUM IN THE SYSTEM LEAD ACETATE, LEAD OXIDE, WATER AT 25°.

(Jackson, 1914.)

d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol. PbO.	$Pb(C_2H_3O_2)_2$.	Solid Phase.	d_{25} of Sat. Sol.	Gms per 100 Gms. Sat. Sol. PbO.	$Pb(C_2H_3O_2)_2$.	Solid Phase.
1.326	−0.27*	35.19	1.3	2.280	24.74	49.21	3.1.3+1.2.4
1.334	+0.10	35.60	"	2.048	23.59	43.17	1.2.4
1.367	1.01	37.14	"	1.951	22.78	40.78	"
1.422	3.38	38.93	"	1.657	19.63	31.40	"
1.531	6.01	41.95	"	1.599	18.73	29.63	"
1.658	9.47	44.71	"	1.382	14.62	20.96	"
...	14.22	47.88	"	1.348	13.41	19.65	"
1.852	14.44	47.92	"	1.229	10.66	12.99	"
...	15.89	48.95	1.3+3.1.3	1.157	8.47	8.64	"
1.930	15.90	48.42	3.1.3	1.119	7.87	5.27	"
1.942	16.25	48.85	"	1.117	7.79	5.25	"
1.956	16.65	49.04	"	...	7.17	4.17	$Pb(OH)_2$
2.024	18.83	48.71	"	1.100	6.84	4.31	"
2.161	22.23	48.52	"	1.095	6.54	4.25	"
2.193	22.94	48.96	"	1.085	5.91	3.82	"
...	23.28	49.14	"	1.075	5.29	3.40	"
2.220	23.53	49.01	"	...	0.20	0.11	"

* In this case the acidity is expressed in terms of PbO.

1.3 = $Pb(C_2H_3O_2)_2.3H_2O$, 3.1.3 = $3Pb(C_2H_3O_2)_2.PbO.3H_2O$, 1.2.4 = $Pb(C_2H_3O_2)_2.2PbO.4H_2O$.

The above results show the solubility of lead acetate in aqueous solutions containing increasing amounts of lead hydroxide. The mixtures were constantly agitated for periods varying from 2 to 7 days. Both the saturated solutions and the solid phases were analyzed. The basic lead in a given sample was determined by measuring the volume of standard acid neutralized by it. The neutral lead acetate was determined by precipitation of the lead as sulfate or as oxalate.

SOLUBILITY OF LEAD ACETATE IN AQ. SOLUTIONS OF POTASSIUM ACETATE AT 25°.

(Fox, 1909)

Gms. per 100 Gms Sat. Sol. CH_3COOK.	$(CH_3COO)_2Pb$.	Solid Phase.
0	35.9	$(CH_3COO)_2Pb.3H_2O$
13.87	38.05	"
15.40	36.90	"

SOLUBILITY OF LEAD ACETATE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°.

(Seidell, 1910)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $(C_2H_3O_2)_2Pb$ per 100 Gms. Sat. Sol.	Solid Phase.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $(C_2H_3O_2)_2Pb$ per 100 Gms. Sat. Sol.	Solid Phase.
0	1.343	36.5	$(C_2H_3O_2)_2Pb.3H_2O$	70	0.955	12.4	$(C_2H_3O_2)_2Pb.3H_2O$
10	1.275	32.3	"	80	0.907	9.4	"
20	1.215	28.6	"	81	0.905	9	"
30	1.157	25	"	85	0.855	4	$(C_2H_3O_2)_2Pb$
40	1.105	21.9	"	90	0.826	1.6	"
50	1.055	18.7	"	95	0.806	0.6	"
60	1.002	15.6	"	100	0.790	0.4	"

100 gms. 95% formic acid dissolve 0.99(?) gm. $Pb(C_2H_3O_2)_2$ at 19.8°. (Aschan, 1913.)
100 gms. anhydrous lanolin (m. pt. 46°) dissolve 1.1 gm. $Pb(C_2H_3O_2)_2$ at 45°. (Klose, '07.)
100 gms. glycerol dissolve about 20 gms. $Pb(C_2H_3O_2)_2$ at 15°. (Ossendowski, 1907.)

LEAD ARSENATE $PbHAsO_4$.

Two gm. portions of amorphous dilead arsenate were agitated at 32° with 90 to 180 cc. portions of 0.0338 normal aqueous ammonia for two days. The saturated solutions were found to contain only traces of lead but amounts of As_2O_5 varying from 1.956 to 1.429 gms. per liter. (McDonnell and Smith, 1916.)

LEAD BENZOATE $Pb(C_7H_5O_2)_2.H_2O$.

SOLUBILITY IN WATER.
(Pajetta, 1906.)

t°.	18°.	40.6°.	49°.
Gms. $Pb(C_7H_5O_2)_2$ per 100 gms. sat. sol.	0.149	0.249	0.310

LEAD BORATE $Pb(BO_2)_2.H_2O$.

100 cc. anhydrous hydrazine dissolve about 2 gms. $Pb(BO_2)_2$ at room temp.
(Welsh and Broderson, 1915.)

LEAD BROMATE $Pb(BrO_3)_2.H_2O$.

100 gms. water dissolve 1.32 gms. $Pb(BrO_3)_2$ at 19.94°.
(Rammelsberg, 1841; Böttger, 1903.)

LEAD BROMIDE $PbBr_2$.

SOLUBILITY IN WATER.
(Lichty — J. Am. Chem. Soc. 25, 474, '03.)

t°.	Density of Solutions, H_2O at 0°.	Gms. $PbBr_2$ per 100 cc. Solution.	Gms. $PbBr_2$ per 100 Gms. H_2O.	Milligram Mols. $PbBr_2$ per 100 cc. Solution.	Milligram Mols. $PbBr_2$ per 100 Gms. H_2O.
0	1.0043	0.4554	0.4554	1.242	1.242
15	1.0053	0.7285	0.7305	1.987	1.989
25	1.0061	0.9701	0.9744	2.646	2.655
35	1.0060	1.3124	1.3220	3.577	3.603
45	1.0059	1.7259	1.7457	4.705	4.760
55	1.0046	2.1024	2.1376	5.731	5.827
65	1.0028	2.516	2.574	6.859	7.016
80	1.0000	3.235	3.343	8.819	9.113
95	0.9995	4.1767	4.3613	11.386	11.890
100	...	4.550	4.751	12.40	12.94

SOLUBILITY OF LEAD BROMIDE IN AQUEOUS HYDROBROMIC ACID AT 10°.

100 grams H_2O containing 72.0 grams HBr dissolve 55.0 grams $PbBr_2$ per 100 gms. solvent, and solution has Sp. Gr. 2.06.
(Ditte — Compt. rend 92, 719, '81.)

SOLUBILITY OF LEAD BROMIDE IN PYRIDINE.
(Heise, 1912)

t°.	Gms $PbBr_2$ per 100 Gms Pyridine.	Solid Phase.	t°.	Gms $PbBr_2$ per 100 Gms Pyridine.	Solid Phase.
−26	1.02	$PbBr_2.3C_5H_5N$	45	0.661	$PbBr_2.2C_5H_5N$
−10	0.89	"	64	0.800	"
− 5	0.84	"	77	0.969	"
0	0.80	"	95	1.33	"
+13	0.661	"	100	1.44	"
19 tr. pt.	...	" $+PbBr_2.2C_5H_5N$	105	1.56	"
26	0.583	$PbBr_2.2C_5H_5N$			

FREEZING-POINT DATA (Solubility, see footnote, p. 1) ARE GIVEN FOR THE FOLLOWING MIXTURES OF LEAD BROMIDE AND OTHER COMPOUNDS.

Lead Bromide + Lead Chloride	(Mönkemeyer, 1906.)
" " + Lead Iodide	"
" " + Lead Fluoride	(Sandonnini, 1911.)
" " + Lead Oxide	(Sandonnini, 1914.)
" " + Mercuric Bromide	(Sandonnini, 1912, 1914.)
" " + Silver Bromide	(Matthes, 1911.)

LEAD Dicyclohexyl DiBROMIDE $(C_6H_{11})_2PbBr_2$.

LEAD Dicyclohexyl DiCHLORIDE $(C_6H_{11})_2PbCl_2$.

SOLUBILITY OF EACH IN SEVERAL SOLVENTS AT 22.5°.
(Grüttner, 1914.)

Solvent.	Grams per 100 Grams Solvent. $(C_6H_{11})_2PbBr_2$.	$(C_6H_{11})_2PbCl_2$.
Benzene	0.014	0.016
Carbon Tetrachloride	0.004	0.004
Chloroform	0.078	0.083
Alcohol + Pyridine (1:1)	2.560	2.904

Similar results are also given for lead tetracyclohexyl, $Pb(C_6H_{11})_4$, lead tetraphenyl, $Pb(C_6H_5)_4$, and lead diphenyldicyclohexyl, $Pb(C_6H_5)_2(C_6H_{11})_2$.

Solvent.	Gms. per 100 Gms. Solvent.		
	$Pb(C_6H_{11})_4$.	$Pb(C_6H_5)_4$.	$Pb(C_6H_5)_2(C_6H_{11})_2$.
Alcohol	0.010	0.020	0.324
Benzene	1.068	1.145	2.298
Carbon Tetrachloride	0.244	0.303	0.845
Ethyl Acetate	0.030	0.123	0.231

LEAD CAPROATE, CAPRYLATE, CAPRATE, etc.

SOLUBILITY OF EACH IN ETHER AND IN PETROLEUM ETHER.
(Neave, 1912.)

Lead Salt.	Melting point.	Solubility in Ethyl Ether. Gms Salt per 100 cc. Sat. Sol. At 20°.	At B. pt. of Sat. Sol.	Solubility in Pet. Ether. Gms. Salt per 100 cc. Sat. Sol. At 20°.	At B. pt. of Sat. Sol.
Pb Caproate	73–74	...	1.364	...	0 0608
" Heptylate	90.5–91.5	0.2397	1.490	0.020	0.0528
" Caprylate	83.5–84.5	0.0938	0.546	practically insol.	0 0384
" Nonylate	94–95	0.1115	0.2404	"	0.0450
" Caprate	100	0.0290	0.4285	"	0.0170
" Myristate	107	practically insol.	0.0555	"	0.0210
" Laurate	103–104	"	0.0205	"	practically insol.
" Palmitate	112	"	0.0261	"	"
" Stearate	125	"	practically insol.	"	0.0170

The ethyl ether was distilled over sodium. Petroleum ether distilling between 40°–60° was used. The solutions were stirred constantly at 20°. A definite volume of the sat. solution was evaporated to dryness and residue weighed in each case.

LEAD CARBONATE $PbCO_3$.

SOLUBILITY IN WATER BY ELECTRICAL CONDUCTIVITY METHOD.
(Kohlrausch and Rose, 1893; Böttger, 1903)

1 liter of water dissolves 0.0011 – 0.0017 gm. $PbCO_3$ at 20°.

SOLUBILITY OF LEAD CARBONATE (NEUTRAL) IN AQUEOUS SOLUTIONS OF CARBON DIOXIDE AT 18°.
(Pleissner, 1907.)

Millimols per Liter. CO_2.	$PbCO_3$.	Milligrams per Liter. CO_2.	$PbCO_3$.
0	0.008	0	1.75
0.064	0.029	2.8	6
0.123	0.034	5.4	7
0.328	0.040	14.4	8.2
0.592	0.048	26	9.9
0.988	0.053	43.5	10.9
2.40	0.076	106	15.4

A determination of the solubility of basic lead carbonate in water gave 1.6 mg. $Pb_3(CO_3)_2(OH)_2$ per liter = 1.3 mg. Pb or 0.006 millimol Pb.

Data for equilibrium in the system composed of $K_2CO_3 + PbCO_3 + K_2CrO_4 + PbCrO_4$ at 25° are given by Goldblum and Stoffella, 1910.

Data for equilibrium by lead carbonate precipitation in aq. solutions of sodium salts at 25° are given by Herz, 1911.

LEAD CHLORATE $Pb(ClO_3)_2.H_2O$.

100 grams H_2O dissolve 151.3 gms. $Pb(ClO_3)_2$, or 100 gms. sat. solution contain 60.2 gms. $Pb(ClO_3)_2$ at 18°. Density of solution, 1.947. (Mylius and Funk, 1897.)

100 gms. H_2O dissolve 440 gms. $Pb(ClO_3)_2$ at 18°, d_{18} = 1.63. (Carlson, 1910.)

LEAD CHLORIDE $PbCl_2$.

SOLUBILITY IN WATER. (Lichty; see also Formanek, 1887; Bell, 1867; Ditte, 1881.)

t°.	Density of Solutions, H_2O at 0°.	Gms. $PbCl_2$ per 100 cc. Solution.	Gms. $PbCl_2$ per 100 Gms. H_2O.	Milligram Mols. $PbCl_2$ per 100 cc. Solution.	Milligram Mols. $PbCl_2$ per 100 Grams H_2O.
0	1.0066	0.6728	0.6728	2.421	2.421
15	1.0069	0.9070	0.9090	3.265	3.272
25	1.0072	1.0786	1.0842	3.882	3.903
35	1.0060	1.3150	1.3244	4.733	4.767
45	1.0042	1.5498	1.5673	5.579	5.644
55	1.0020	1.8019	1.8263	6.486	6.573
65	0.9993	2.0810	2.1265	7.490	7.651
80	0.9947	2 5420	2.6224	9.150	9.439
95	0.9894	3.0358	3 1654	10.926	11.394
100	...	3 208	3 342	11.52	12.01

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF ACETIC ACID AT 25°. (Hill, 1917)

Normality of Acetic Acid.	Dissolved $PbCl_2$ Gms per Liter.	Dissolved $PbCl_2$ Equiv. per Liter.	Normality of Acetic Acid	Dissolved $PbCl_2$ Gms. per Liter.	Dissolved $PbCl_2$ Equiv. per Liter.
0	10.77	0 07753	0 465	10.27	0.07392
0.05	10.82	0 07782	0 929	9.45	0.06803
0.10	10 85	0 07717	1 845	7.90	0.05686
0.20	10.70	0 07703	3 680	5.26	0 03788

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS AMMONIUM CHLORIDE AT 22°. (Bronsted, 1911)

Gm Equivalents per Liter. NH_4Cl.	Gm Equivalents per Liter. $PbCl_2$	Solid Phase.	Gm Equivalents per Liter. NH_4Cl.	Gm Equivalents per Liter. $PbCl_2$	Solid Phase.
0	0 0749	$PbCl_2$	0.8	0 0087	$NH_4Cl.2PbCl_2$
0.1	0 0325	"	1	0 0080	"
0.2	0.0194	"	1.5	0 0073	"
0.4	0.0138	"	2.5	0.0092	"
0.5	0.0130	"	4	0 0182	"
0.52	0.0127	" $+NH_4Cl.2PbCl_2$	6	0.0473	"
0.55	0 0123	$NH_4Cl\ 2PbCl_2$	7.29	0 0898	" $+NH_4Cl$
0.65	0 0105	"	7.29	0	NH_4Cl

For additional results at 25.2° see von Ende, 1901.

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID.

Results at 18°. (Pleissner, 1907)

Normality of HCl.	Gms $PbCl_2$ per Liter.
0	9.34
0.0001	9.305
0.0002	9.300
0.0005	9.243
0.00102	9.200
0.0102	8.504

Results at 25.2°. (von Ende, 1901)

Normality of HCl.	Millimols $PbCl_2$ per Liter.	Normality of HCl.	Millimols $PbCl_2$ per Liter.
0	38.8	1.026	4.41
0.0045	37.35	2.051	5.18
0 0151	33.75	3.085	7.78
0.0452	25.46	5	19.38
0.1850	10.25	7.5	65.86
0.5142	5.37	12.05	164.30

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID.

(At 0°, Engel — Ann. chim. phys. [6] 17, 359, '89; at 25°, Noyes — Z. physik. Chem. 9, 623, '92; at different temperatures, Ditte — Compt. rend. 92, 718, '81; see also Bell — J. Chem. Soc. 21, 350, '68.)

Gms. HCl per Liter.	Gms. $PbCl_2$ per Liter at: 0°.	25°.
0	5.83	10.79
0.5	4.5	9.0
1.0	3.6	7.6
2.0	2.2	6.0
3.0	1.6	5.0
6	1.4	3.1
10	1.2	1.8
100	1.2	...
200	5.2	...
250	10.5	...
300	17.5	...
400	40.0	...

Gms. HCl per 100 Gms. H_2O.	Gms. $PbCl_2$ per 100 Gms. Solution at: 0°.	20°.	40°.	55°.	80°.
0	8.0	11.8	17.0	21.0	31.0
100	1.2	1.4	3.2	5.5	12.0
150	1.5	2.0	5.0	7.5	16.0
200	3.5	5.0	8.2	11.7	21.5
250	6.5	8.0	13.0	16.2	28.5
300	10.7	12.5	17.5	22.0	35.0
400	21.5	24.0	...	...	...

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SALT SOLUTIONS AT 25°.

(Noyes; in $HgCl_2$ solutions at 20°, Formanek — Chem. Centralb. 270, '87.)

In Aqueous Solutions of:

HCl, KCl, $MgCl_2$, $CaCl_2$, $MnCl_2$ and $ZnCl_2$ Gram Equivalents per Liter of: Salt.	$PbCl_2$.	In $CdCl_2$ Gram Equiv. per Liter. $CdCl_2$.	$PbCl_2$.	In $HgCl_2$ Gram Equiv. per Liter. $HgCl_2$.	$PbCl_2$.	In $Pb(NO_3)_2$ Gram Equiv. per Liter. $Pb(NO_3)_2$.	$PbCl_2$.
0.0	0.0777	0.00	0.0777	0.0	0.0777	0.0	0.0777
0.05	0.050	0.05	0.0601	0.1	0.0992	0.2	0.0832
0.10	0.035	0.10	0.0481				
0.20	0.021	0.20	0.0355				

The above results were calculated to grams per liter plotted on cross-section paper, and the figures in the following table read from the curves.

Gms. Salt per Liter.	Grams $PbCl_2$ per Liter in Aqueous Solutions of: HCl.	KCl.	$MgCl_2$.	$CaCl_2$.	$MnCl_2$.	$ZnCl_2$.	$CdCl_2$.	$HgCl_2$.		$Pb(NO_3)_2$
0	10.79	10.79	10.79	10.79	10.79	10.79	10.79	10.79(N)	9.71(F)	10.79
1	8.5	9.3	7.7	8.7	9.5	...	10.2	11.0	9.8	10.8
2	6.5	8.2	6.5	7.6	8.3	...	9.7	11.4	10.0	10.85
3	5.2	7.2	5.7	6.7	7.3	...	9.2	11.7	10.3	10.87
4	4.3	6.5	5.2	6.0	6.3	...	8.6	12.0	10.5	10.90
6	3.2	5.3	4.4	4.8	5.0	...	7.7	12.7	11.0	10 95
8	2.5	4.5	...	3.9	4.1	...	7.0	13.3	11.6	11.00
10	2.1	3.9	...	3.3	3.5	...	6.3	14.0	12.2	11.05
14	...	3.1	...	...	2.8	3.0	5.4	...	13.2	11.15
20	...	...	...	...	...	...	4.7	...	14.8	11.20
40	...	...	...	...	...	...	...	...	19.0	11.70

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF LEAD NITRATE AT 25°.

Results by Harkins, 1911.

Gms. per Liter Sat. Sol. $Pb(NO_3)_2$.	$PbCl_2$.	$d_{25/4}$ of Sat. Sol.
0	10.81	1.0069
3.31	10.67	1.0095
8.28	10.65	1.0139
16.56	10.84	1.0210
33.12	11.57	...

Results by Armstrong and Eyre, 1913.

Aq $Pb(NO_3)_2$ Sol., Gms. per 1000 Gms. H_2O.	Gms. $PbCl_2$ per 1000 Gms. Sat. Sol.
0	10.89
3.31	10.96
6.62	10.53
33.12	11.15
82.80	12.95

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 25.2°. (von Ende, 1901.)

Normality of KCl.	Gm Equiv. $PbCl_2$ per Liter.	Normality of KCl.	Gm. Equiv. $PbCl_2$ per Liter
0	0.07760	0.0999	0.02380
0.001	0.07664	0.5006	0.01480
0.0025	0.07570	0.7018	0 01476
0.0049	0.07404	0.9991	0.00980
0.0099	0.07056	1.5018	0.00996
0.0200	0.06432	2.0024	0.01112
0.0599	0.04524	3.0036	0.01948

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 20°. (Bronsted, 1912.)

Gm. Equivalents per 1000 Gms. Solution. KCl.	$PbCl_2$.	Solid Phase.	Gm Equivalents per 1000 Gms Solution KCl	$PbCl_2$.	Solid Phase.
0.195	0.01900	$PbCl_2$	2.10	0.01022	$2PbCl_2.KCl$
0.299	0.01452	"	2.20	0.01060	"
0.375	0.01324	"	2.29	0.01184	"
0.483	0.01236	"	2.36	0.01300	$2PbCl_2$ KCl+$PbCl_2$.KCl.½H_2O
0.510	0.0125	" +$2PbCl_2$ KCl	2.45	0.01308	$PbCl_2$.KCl.½H_2O
0.575	0.01068	$2PbCl_2$.KCl	2.66	0.01396	"
0.639	0.00954	"	2.77	0 01476	"
0.930	0.00770	"	2 91	0.01550	"
1.224	0.00736	"	3 05	0.01656	"
1.575	0.00786	"	3 18	0.01780	"
1.884	0.00894	"	4.57*	0.0280*	" +KCl

* = Gm equivalents per 1000 Gms H_2O.

Data for the solubility of lead chloride in aqueous KCl and aqueous NaCl are given by Demassieux, 1914.

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF ALCOHOL AND OF MANNITOL AT 25°. (Kernot and Pomilio, 1912)

Results for Aqueous Ethyl Alcohol.

Gms per Liter Solution C_2H_5OH.	$PbCl_2$.
0	10.75
5.75	10.16
11.51	9.36
23.02	9.14
46.05	8.25
92.10	7.12
184.20	4.76

Results for Aqueous Mannitol.

Gms per Liter Solution $(CH_2OH)_2(CHOH)_4$.	$PbCl_2$.
0	10.75
2.84	10.42
5.69	10.67
11.38	10.64
22.76	10.91
45.53	11.16
91.06	11.29

SOLUBILITY OF LEAD CHLORIDE IN GLYCEROL. (Presse, 1874.)

1 part glycerol + 7 parts H_2O dissolve 0.91 per cent $PbCl_2$.
1 part glycerol + 3 parts H_2O dissolve 1.04 per cent $PbCl_2$.
1 part glycerol + 1 part H_2O dissolves 1.32 per cent $PbCl_2$.
Pure glycerol dissolves 2 per cent $PbCl_2$.

SOLUBILITY OF LEAD CHLORIDE IN AQUEOUS SOLUTIONS OF SEVERAL COMPOUNDS AT 25°. (Armstrong and Eyre, 1913.)

Aqueous Solution of:	Gms. Cmpd. per 1000 Gms. H_2O.	Gms. $PbCl_2$ per 1000 Gms. Sat. Sol.	Aqueous Solution of:	Gms. Cmpd. per 1000 Gms. H_2O.	Gms. $PbCl_2$ per 1000 Gms Sat. Sol.
Water alone	0	10.89	Ethyl Alcohol	11.51	10.43
Glycol	15.51	10.75	Glycerol	23.01	10.98
"	62.04	10.90	Propyl Alcohol	15.01	10.08
Acetaldehyde	11.01	10.54	" "	60.06	9.37
"	33.03	9.82	Methyl Acetanilide	29.82	10.25
Paraldehyde	11.01	10.50	Hydrochloric Acid	9.12	4.23
"	33.02	9.96	" "	18.23	3.60

100 cc. anhydrous hydrazine dissolve 3 gms. $PbCl_2$ at ord. temp. with decomposition. (Welsh and Broderson, 1915.)

SOLUBILITY OF LEAD CHLORIDE IN PYRIDINE. (Heise, 1912.)

t°.	Gms. $PbCl_2$ per 100 Gms. Pyridine.	Solid Phase.	t°.	Gms. $PbCl_2$ per 100 Gms. Pyridine.	Solid Phase.
−20	0.303	$PbCl_2.2C_5H_5N$	76	0.893	$PbCl_2.2C_5H_5N$
0	0.364	"	90	1.07	"
+22	0.459	"	94	1.12	"
44	0.559	"	102	1.31	"
65	0.758	"			

FREEZING-POINT DATA (Solubility, see footnote, p. 1) ARE GIVEN FOR THE FOLLOWING MIXTURES OF LEAD CHLORIDE AND OTHER COMPOUNDS.

Lead Chloride + Lead Fluoride	(Sandonnini, 1911)
" " + Lead Iodide	(Monkemeyer, 1906.)
" " + Lead Oxide	(Ruer, 1906)
" " + Lead Sulfide	(Truthe, 1912)
" " + Lithium Chloride	(Tries, 1914)
" " + Magnesium Chloride	(Menge, 1911.)
" " + Manganese Chloride	(Sandonnini, 1911, 1914.)
" " + Potassium Chloride	(Tries, 1914; Lorenz and Ruckstuhl, 1906.)
" " + Rubidium Chloride	"
" " + Silver Chloride	(Matthes, 1911; Tries, 1914.)
" " + Strontium Chloride	(Sandonnini, 1911, 1914.)
" " + Sodium Chloride	(Tries, 1914.)
" " + Thallium Chloride	(Korreng, 1914; Sandonnini, 1913.)
" " + Tin Chloride	(Hermann, 1911; Sandonnini, 1911, 1914.)
" " + Zinc Chloride	(Herrmann, 1911.)

LEAD CHLORIDE (Basic).

SOLUBILITY OF BASIC LEAD CHLORIDES IN WATER AT 18°. (Pleissner, 1907.)

Compound	Formula.	Gms. per Liter Sat Aq. Solution. Pb	= Pb Salt.
½ Basic Lead Chloride	$PbCl_2.PbO.H_2O$	0.079	0.099
¾ " " "	$PbCl_2.3PbO.H_2O$	0.021	0.025

LEAD FluoroCHLORIDE PbFCl.

SOLUBILITY OF LEAD FLUOROCHLORIDE IN WATER AND IN AQUEOUS SOLUTIONS. (Stark, 1911.)

Solubility in Water. Solubility in Aq. Solutions at 25°.

t°.	Gms. PbFCl per 100 Gms. H_2O.	Aq. Solution of:	Gms. PbFCl per 100 cc. Sat. Sol.	Aq. Solution of:	Gms. PbFCl per 100 cc. Sat. Sol.
0	0.0211	0.00996 *n* $PbCl_2$	0.0030	0.0535 *n* HCl	0.0758
18	0.0325	0.0195 *n* "	0.0008	0.1069 *n* "	0.1006
25	0.0370	0.0392 *n* "	0.0005	0.0518 *n* CH_3COOH	0.0512
100	0.1081			0.1055 *n* "	0.0561

LEAD CHROMATE $PbCrO_4$.

SOLUBILITY OF LEAD CHROMATE IN WATER.

t°.	Mols. $PbCrO_4$ per Liter.	Gms. $PbCrO_4$ per Liter.	Method.	Authority.
18	$3.0.10^{-7}$	0.00010	Solution equilibrium	(Beck and Stegmüller, 1910.)
..	$1.4.10^{-7}$	0.00004	" "	(Auerbach and Pick.)
18	$3.2.10^{-7}$	0.00010	Conductivity	(Kohlrausch, 1908.)
20	$2.1.10^{-7}$	0.00007	Radio Indicators	(v. Hevesy and Rona, 1915.)

SOLUBILITY OF LEAD CHROMATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC AND OF NITRIC ACIDS. (Beck and Stegmüller, 1910, 1911.)

Normality of HCl.	Solubility in Aq. HCl. Milligrams Pb per 100 cc. Sat Sol. at: 18°.	25°.	37°.	Solubility in Aq. HNO_3 at 18°. Normality of HNO_3.	Milligrams Pb per 100 cc. Sat. Sol.
0.1	3.86	4.96	7.40	0.1	2.67
0.2	8.15	10.06	15.40	0.2	4.70
0.3	13.56	17.38	27.30	0.3	6.46
0.4	22.14	27.78	43.60	0.4	8.31
0.5	32.30	42.00	68	0.5	10.31
0.6	46.60	61.06	97.20	0.6	12.39

Results are also given for the solubility of mixtures of lead chromate and lead sulfate in aqueous hydrochloric acid at 25° and 37°.

SOLUBILITY OF LEAD CHROMATE IN AQUEOUS POTASSIUM HYDROXIDE SOLUTIONS. (Lacland and Lepierre, 1891)

t°.	Grams KOH per 100 cc.	Grams $PbCrO_4$ per 100 cc.
15	2.308	1.19
60	2.308	1.62
80	2.308	2.61
102	2.308	3.85

LEAD CITRATE $Pb(C_6H_5O_7)_2.H_2O$.

SOLUBILITY IN WATER AND IN ALCOHOL.

100 gms. H_2O dissolve 0.04201 gm. $Pb(C_6H_5O_7)_2.H_2O$ at 18°, and 0.05344 gm. at 25°.

100 gms. alcohol (95%) dissolve 0.0156 gm. $Pb(C_6H_5O_7)_2.H_2O$ at 18°, and 0.0167 gm. at 25°. (Partheil and Hübner — Archiv. Pharm. 241, 413, '03.)

LEAD DOUBLE CYANIDES.

SOLUBILITY IN WATER.
(Schuler — Sitzber. Akad. Wiss. Wien, 79, 302, '79.)

Double Salt.	Formula.	t°.	Gms. per 100 Gms. H_2O.
Lead Cobalticyanide	$Pb_3[Co(CN)_6]_2.7H_2O$	18	56.5
Lead Cobalticyanide	$Pb_3[Co(CN)_6]_2.7H_2O$	19	61.3
Lead Potassium Cobalticyanide	$PbKCo(CN)_6.3H_2O$	18	14.8
Lead Cobalticyanide Nitrate	$Pb_3[Co(CN)_6]_2.Pb(NO_3)_2.12H_2O$	18	5.9
Lead Ferricyanide Nitrate	$Pb_3[Fe(CN)_6]_2.Pb(NO_3)_2.12H_2O$	16	7.5
Lead Potassium Ferricyanide	$PbKFe(CN)_6.3H_2O$	16	21.0

LEAD FLUORIDE PbF_2.

One liter of water dissolves 0.6 gm. PbF_2 at 9°, 0.64 gm. at 18°, and 0.68 gm. at 26.6° (conductivity method). (Kohlrausch, 1908.)

100 cc anhydrous hydrazine dissolve 6 gms. PbF_2 at room temp. with decomposition. (Welsh and Broderson, 1915.)

Freezing-point data (solubility, see footnote, see p. 1) for mixtures of PbF_2 and PbI_2 are given by Sandonnini (1911); for mixtures of PbF_2 + PbO by Sandonnini (1914); for mixtures of PbF_2 + $Pb_3(PO_4)_2$ by Amadari (1912), and for PbF_2 + NaF by Puchin and Baskow (1913).

LEAD FORMATE $Pb(HCOO)_2$.

SOLUBILITY OF LEAD FORMATE IN AQUEOUS SOLUTIONS OF BARIUM FORMATE AT 25°.
(Fock, 1897.)

Mol. % in Solution.		Grams per Liter.		Sp. Gr of Solutions.	In Solid Phase Mol. % of	
$Pb(HCO_2)_2$.	$Ba(HCO_2)_2$.	$Pb(HCO_2)_2$.	$Ba(HCO_2)_2$.		$Pb(HCO_2)_2$.	$Ba(HCO_2)_2$.
0	100	...	28.54	1.2204	0	100
0.29	99.71	1.104	28.65	1.2213	1.72	98.28
0.74	99.26	2.803	28.90	1.2251	5.29	94.71
1.24	98.76	5.309	32.24	1.2529	11.94	88.06
2.91	97.09	11.42	29.29	1.2341	24.81	75.19
5.92	94.08	23.11	28.13	1.2355	56.54	43.46
100	0	28.35	...	1.0911	100	0

LEAD HYDROXIDE $Pb(OH)_2$.

SOLUBILITY OF LEAD HYDROXIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE.
(Moist Lead Hydroxide used, temperature not given.)
(Rubenbauer, 1902.)

Amount of Na in 20 cc.	Amt of Pb in 20 cc	Mol. Dilution of NaOH.	Grams per 100 cc. Solution.	
			NaOH	$Pb(OH)_2$
0.2024	0.1012	2.27	1.759	0.590
0.3196	0.1736	1.44	2.778	1.010
0.5866	0.3532	0.785	5.10	2.056
0.9476	0.4071	0.485	8.235	2.370
1.7802	0.5170	0.258	15.470	3.010

LEAD IODATE $Pb(IO_3)_2$.

One liter of water dissolves 0.0134 gm. $Pb(IO_3)_2$ at 9.2°, 0.019 gm. at 18° and 0.023 gm. at 25.8°. (Kohlrausch, 1908; Bottger, 1903.)

One liter H_2O dissolves 0.0307 gm. $Pb(IO_3)_2$ at 25°. (Harkins and Winninghoff, 1911.)

SOLUBILITY OF LEAD IODATE IN AQUEOUS SALT SOLUTIONS AT 25°.
(H. and W., 1911.)

Gms. per Liter.		Gms per Liter		Gms per Liter	
KNO_3.	$Pb(IO_3)_2$	KIO_3	$Pb(IO_3)_2$.	$Pb(NO_3)_2$	$Pb(IO_3)_2$.
0.202	0.0318	0.0113	0.0199	1.656	0.0052
1.011	0.0363	0.0227	0.0122	16.561	0.0045
5.055	0.0567	$Pb(NO_3)_2$.		82.805	0.0078
20.220	0.0708	0.0165	0.0242	496.83	0.0418
		0.165	0.0115		

LEAD IODIDE PbI_2.

SOLUBILITY IN WATER.
(Lichty, 1903.)

t°.	Density. (H_2O at 0°.)	Grams PbI_2 per 100.		Millimols PbI_2 per 100.	
		cc. Solution.	Grams H_2O.	cc Solution	Grams H_2O.
0	1.0006	0.0442	0.0442	0.096	0.096
15	0.9998	0.0613	0.0613	0.133	0.133
25	0.9980	0.0762	0.0764	0.165	0.166
35	0.9951	0.1035	0.1042	0.224	0.226
45	0.9915	0.1440	0.1453	0.312	0.315
55	0.9872	0.1726	0.1755	0.374	0.381
65	0.9827	0.2140	0.2183	0.464	0.473
80	0.9745	0.2937	0.3023	0.637	0.656
95	0.9671	0.3814	0.3960	0.828	0.859
100	...	0.420	0.436	0.895	0.927

Data for the solubility of lead iodide in water by the conductivity method are given by Böttger, 1903; Kohlrausch, 1904–05; Denham, 1917.

SOLUBILITY OF LEAD NITRATE IN CONCENTRATED AQUEOUS SOLUTIONS OF SODIUM NITRATE AND VICE VERSA, DETERMINED BY SYNTHETIC METHOD.

(Isaac, 1908.)

(The several mixtures were enclosed in sealed tubes and heated until only one or two very small crystals remained undissolved. The temperature was then determined at which the edges of these crystals just showed a change from sharp to round or vice versa.)

Results for Lead Nitrate as Solid Phase.

t° of Saturation.	Gms. per 100 Gms. Sat. Sol. $NaNO_3$.	$Pb(NO_3)_2$.
32	34.42	19.69
35.5	34.15	20.33
39.5	33 71	21.35
44	33 35	22 19
49.1	32 94	23.15
55	32.60	23.93
58	32.47	24.24
62	32.33	24.57
65	32.19	24.89

Results for Sodium Nitrate as Solid Phase.

t° of Saturation.	Gms. per 100 Gms. Sat. Sol. $NaNO_3$.	$Pb(NO_3)_2$.
21	40.97	13.62
26.5	42.04	13.38
31	43.18	12.88
38.8	44.63	12.78
41	45.11	12.94
44.25	46.03	12.45
51	47.28	12.50
58	49.03	11.76
64	49.92	11.56

SOLUBILITY OF MIXED CRYSTALS OF LEAD NITRATE AND STRONTIUM NITRATE IN WATER AT 25°.

(Fock, 1897.)

Mol. per cent in Solution. $Pb(NO_3)_2$.	$Sr(NO_3)_2$.	Gms. per 100 cc. Solution $Pb(NO_3)_2$.	$Sr(NO_3)_2$.	Sp Gr of Solutions.	Mol. per cent in Solid Phase. $Pb(NO_3)_2$.	$Sr(NO_3)_2$.
100	0	46.31	0	1 4472	100	0
87.41	12 39	50 47	4 56	1 4336	99 05	0.95
78.68	21 32	53.92	8.14	1.4288	98.11	1.89
56.39	43 61	45.34	17.81	1.4263	97.02	2.98
60.29	39.71	44.48	18 74	1.4245	96.06	3 94
33.70	36 30	25.23	35.03	1.4468	83 84	16.16
24.58	75.42	19.13	37 54	1.4867	32.88	67.12
0	100	0	71.04	1.5141	0	100

SOLUBILITY OF LEAD NITRATE IN ETHYL AND METHYL ALCOHOL.

Solvent:	Gms. $Pb(NO_3)_2$ per 100 Gms Solvent at: 4°.	8°.	22°.	40°.	50°.	
Aq. C_2H_5OH (Sp. Gr. 0.9282)	4.96	5.82	8.77	12.8	14.9	(G)
Abs. C_2H_5OH	...	...	0 04 (20 5°)	...	...	(de B)
Abs. CH_3OH	...	...	1.37	...	...	"

(Gerardin, 1865; de Bruyn, 1892.)

100 cc. anhydrous hydrazine dissolve 52 gms. lead nitrate at room temperature with formation of a yellow precipitate. (Welsh and Broderson, 1915.)

SOLUBILITY OF LEAD NITRATE IN PYRIDINE.

(Walton and Judd, 1911.)

t°.	Gms. $Pb(NO_3)_2$ per 100 Gms. Pyridine.	Solid Phase.	t°.	Gms. $Pb(NO_3)_2$ per 100 Gms. Pyridine.	Solid Phase.
−19.4	2.93	$Pb(NO_3)_2.4C_5H_5N$	45	22.03	$Pb(NO_3)_2.4C_5H_5N$
−14.5	2.14	"	49.97	29.37	"
−10	1 90	"	51 tr. pt.	...	" $+Pb(NO_3)_2.3C_5H_5N$
0	3.54	"	59 52	36.70	$Pb(NO_3)_2.3C_5H_5N$
5.4	3 93	"	70	47.29	"
8.7	5.39	"	80	61.60	"
14.72	6.13	"	89 93	90.21	"
19.97	6.78	"	94 94	128.06	"
24.75	8.56	"	96 tr. pt.	...	" $+3Pb(NO_3)_2.2C_5H_5N$
30.03	10 98	"	99 89	143.36	$3Pb(NO_3)_2.2C_5H_5N$
34.97	13.20	"	104.90	152	"
40.03	16 94	"	109.90	163.80	

SOLUBILITY OF LEAD NITRATE-NITRITE, $Pb(NO_3)_2.Pb(NO_2)_2.2Pb(OH)_2.2H_2O$, IN AQUEOUS SOLUTIONS OF ACETIC ACID AT 13.3°.

(Chilesotti, 1908.)

Normality of Acetic Acid	Gms. PbO per 100 cc. Sat. Sol.	Normality of Acetic Acid.	Gms. PbO per 100 cc. Sat. Sol.
0	0.601	0.25	5.450
0.05	1.323	0.50	9.690
0.10	2.185	0.75	15.874

LEAD OXALATE PbC_2O_4.

One liter of water dissolves 0.0015 gm. PbC_2O_4 at 18° (conductivity method). (Böttger — Z. physik. Chem. 46, 602, '03; Kohlrausch — *Ibid* 50, 356, '04–'05.)

LEAD OXIDES. SOLUBILITY IN WATER.

(Böttger; Ruer — Z. anorg. Chem. 50, 273, '06.)

No.	Description of Oxide.	Gm. Equiv. per Liter.	Gms. per Liter.
1.	Yellow Oxide, by boiling Pb hydroxide with 10% NaOH	1.03×10^{-4}	0.023
2.	Red Oxide, by boiling Pb hydroxide with conc. NaOH	0.56×10^{-4}	0.012
3.	Yellow Oxide, by heating No. 1 to 630°	1.05×10^{-4}	0.023
4.	Yellow Oxide, by heating No. 2 to 740°	1.00×10^{-4}	0.022
5.	Yellow Oxide, by heating com. yellow brown oxide to 620°	1.09×10^{-4}	0.024
6.	Yellow Brown Oxide commercially pure	1.10×10^{-4}	0.024
7.	Yellow Brown Oxide, by long rubbing of No. 5.	1.12×10^{-4}	0.025

Böttger gives for three samples of lead oxide, 0.017, 0.021, and 0.013 gm. per liter respectively.

One liter H_2O dissolves 0.068 gm. PbO at 18°, solid phase PbO and 0.1005 gm. PbO at 18°, solid phase $Pb_3O_2(OH)_2$. (Pleissner, 1907.)

Results for the solubility of hydrated lead oxide in water and dilute H_2SO_4 solutions are given by Sehnal (1909). The results are considerably higher than the above, viz. 0.1385 gm. Pb per 1000 cc. H_2O at 20°; with increase of H_2SO_4 the solubility decreases rapidly.

100 cc. anhydrous hydrazine dissolve 1 gm. lead oxide (red) at room temp. (Welsh and Broderson, 1915.)

Freezing-point lowering data for mixtures of PbO + $PbSO_4$ are given by Schenck and Rassbach, 1908. Data for mixtures of PbO + SiO_2 are given by Weiller, 1911, and by Cooper, Shaw and Loomis, 1909.

LEAD PerOXIDE PbO_2.

The two forms of lead superoxide, (*a*) amorphous and (*b*) crystalline, differ in their solubilities in sulphuric acid. One liter of very concentrated H_2SO dissolves about 0.010 mol. PbO_2 (*b*) at 22°. One liter of conc. H_2SO_4 containing 1720 gms. per liter, dissolves 0.0995 mol. PbO_2 (*a*) at 22°. The solid phase is slowly converted to $Pb(SO_4)_2$. One liter of H_2SO_4 containing 1097 gms. H_2SO_4 per liter dissolves 0.004 mol. PbO_2 at 22°. The solid phase is converted more quickly to $Pb(SO_4)_2$. In more dilute H_2SO_4 solutions no solubility can be detected. (Dolezalek and Finckli, 1906.)

LEAD PALMITATE, LEAD STEARATE. See also p. 360.

100 cc. absolute ether dissolve 0.0138 gm. palmitate and 0.0148 gm. stearate. (Lidoff, 1893.)

LEAD TetraPHENYL $Pb(C_6H_5)_4$.

Freezing-point data for $Pb(C_6H_5)_4$ + $Si(C_6H_5)_4$ are given by Pascal (1912).

LEAD PHOSPHATE (Ortho) $Pb_3(PO_4)_2$.

One liter water dissolves 0.000135 gm. lead phosphate at 20° by conductivity method. (Böttger, 1903.)

One liter of 4.97 per cent aqueous acetic acid solution dissolves 1[illegible] gms. $Pb_3(PO_4)_2$. (Bertrand, 1868.)

[illegible] Mixtures of Lead Iodide and Potassium Iodide in Water.

(Ditte, 1881; Schreinemakers, 1892.)

t°.	Gms. [illegible] Gms. H₂O. [illegible]	Gms. per … Gms. H₂O. KI.	Solid Phase.	t°.	Gms. per 1000 Gms H_2O. PbI_2.	Gms. per 1000 Gms H_2O. KI.	Solid Phase
5	[illegible]	163	Double Salt+PbI_2	50	526.7	1906	Double Salt+KI
[illegible]	[illegible]	260	"	64	789.3	2161	"
[illegible]	[illegible]	325	"	83.5	1,108.6	2434	"
[illegible]	[illegible]	449	"	92	1,273	2566	"
67	[illegible]	751	"	137	2,382	3278	"
80	[illegible]	1186	"	165	4,187	4227	"
80	[illegible]9	976.4	"	218	10,303	...	"
04.5	1[illegible]	1521	"	241	12,803	7998	"
20	2[illegible]	1812	"	242	12,749	...	"
37	2[illegible]	2097	"	250	15,264	...	"
75	5[illegible]	2947	"	157	5,218 gms.	$PbI_2.2KI$	$PbI_2.2KI.2\frac{1}{2}H_2O$
89	[illegible]	3339	"	172	6,489 "	"	"
9	[illegible]6	1352	" +KI	186	7,903 "	"	"
[illegible]	[illegible]3	1384	" "	194	9,266 "	"	"
23	[illegible]3	1510	" "	201	11,320 "	"	"

Ordinary [illegible]ubility method used for temperatures below boiling-point of the [illegible]olution a[illegible] [illegible]ealed tube (with constriction in middle) method used for tem[illegible]eratures a[illegible]e boiling point.

One lite[illegible], aqueous solution of iodine dissolves 0.00216 gm. mols. PbI_2 (0.996 [illegible]) at 2[illegible]. (Fedotieff, 1911–12.)

Solubi[illegible] of Lead Iodide in Acetone, Aniline and Amyl Alcohol.

(von Laszczynski, 1894.)

Solvent.	t°.	Gms. PbI_2 per 100 Gms Solvent.
$(CH_3)_2CO$	59	0.02
$C_6H_5NH_2$	13	0.50
$C_6H_5NH_2$	184	1.10
$C_5H_{11}OH$	133.5	0.02

Solubility of Lead Iodide in Pyridine.

(Heise, 1912.)

t°.	Gms. PbI_2 per 100 Gms. Pyridine.	Solid Phase.	t°.	Gms PbI_2 per 100 Gms. Pyridine.	Solid Phase.
−43.5 f.pt.	...	$PbI_2.3C_5H_5N$	35	0.188	$PbI_2.2C_5H_5N$
−37	0.166	"	57	0.190	"
−20	0.175	"	77	0.228	"
− 9	0.186	"	92	0.290	"
0	0.200	"	98	0.340	"
+ 3	0.215	"	105	0.370	"
[illegible]6 tr. pt.	0.225	$PbI_2.3C_5H_5N+PbI_2.2C_5H_5N$	108	0.410	"
15	0.208	$PbI_2.2C_5H_5N$	112	0.445	"

100 gms. [illegible]5% formic acid dissolve 0.25 gm. PbI_2 at 19.8°. (Aschan, 1913.)

100 cc. a[illegible]hydrous hydrazine dissolve 2 gms. PbI_2 at room temp. with decomposition. (Welsh and Broderson, 1915.)

Freezing-point data for mixtures of lead iodide and silver iodide are given [illegible]y Matthe[illegible] (1911).

Lead Malate $Pb.C_4H_4O_5.3H_2O$.

Solubility in Water and Alcohol.

(Partheil and Hübner, 1903.)

100 gms. H_2O dissolve 0.0288 gm. $PbC_4H_4O_5.3H_2O$ at 18°, and 0.06504 gm. at [illegible].

100 gms. 95% alcohol dissolve 0.0048 gm. $PbC_4H_4O_5.3H_2O$ at 18°–25°. Density of alcohol employed = 0.8092.

LEAD LAURATE, MYRISTATE, PALMITATE and STEARATE.

SOLUBILITY OF EACH IN SEVERAL SOLVENTS.

(Jacobson and Holmes, 1916.)

(See Lithium Laurate, p. 375, for formulas and other details. See also p. 360.)

Solvent.	t°.	Gms. of Each Salt (Determined Separately) per 100 Gms. Solvent.			
		Pb Laurate.	Pb Myristate.	Pb Palmitate.	Pb Stearate.
Water	35	0.009	0.005	0.005	0.00[illegible]
"	50	0.007	0.006	0.007	0.00[illegible]
Abs. Ethyl Alcohol	25	0.009	0.004	0	0
" " "	35	0.032	0.004	0.001	0.00[illegible]
" " "	50	0.264	0.052	0.012	0.00[illegible]
Methyl Alcohol	15.5	0.061	0.056	0.051	0.030
" "	25	0.096	0.078	0.069	0.0[illegible]
" "	35	0.113	0.082	0.076	0.0[illegible]
" "	50	0.280	0.119	0.093	0.083
Ether	14.5	0.010	0.013	0.010	0.007
Ethyl Acetate	14	0.017	0.010	0.009	0.007
" "	35.5	0.035	0.015	0.009	0.008
" "	50	0.201	0.077	0.033	0.020
Benzene	15	0.011	0.010	0.009	0.008

LEAD NITRATE $Pb(NO_3)_2$.

SOLUBILITY IN WATER.

(Mulder; Kremers, 1854; at 15°, Michel and Kraft, 1854; at 17°, Euler, 1904.)

t°.	Grams $Pb(NO_3)_2$ per 100 Gms. Water.		Grams $Pb(NO_3)_2$ per 100 Gms. Solution.	t°.	Grams $Pb(NO_3)_2$ per 100 Gms. Water.		Grams $Pb(NO_3)_2$ per 100 Gms. Solution.
0	36.5(1)	38.8(2)	27.33(3)	40	69.4	75	41.9
10	44.4	48.3	31.6	50	78.7	85	45
17	50	54	34.2	60	88	95	47.8
20	52.3	56.5	35.2	80	107.6	115	52.[illegible]
25	56.4	60.6	36.9	100	127	138.8	57.[illegible]
30	60.7	66	38.8	17	52.76*		34.54*

* Euler.

(1) Mulder, (2) Kremers, (3) Average of M and K.

Density of saturated solution at 17° = 1.405. (Euler.)

100 gms. H_2O dissolve 55.8 gms. $Pb(NO_3)_2$ at 20°. (LeBlanc and Noyes, 1890.)

100 gms. H_2O sat. with $Pb(NO_3)_2 + KNO_3$ at 20° dissolve 95.39 gms. $Pb(NO_3)_2$ +61.05 gms. KNO_3. (LeBlanc and Noyes, 1890.)

100 gms. H_2O sat. with $Pb(NO_3)_2 + NaNO_3$ at 20° dissolve 38.42 gms. $Pb(NO_3)_2$ +84.59 gms. $NaNO_3$. (Le Blanc and Noyes, 1890.)

SOLUBILITY OF LEAD NITRATE IN AQUEOUS SOLUTIONS OF COPPER NITRATE AT 20°.

Fedotieff, 1911–12.)

Gms. per 100 Gms. H_2O. $Cu(NO_3)_2$.	Gms. per 100 Gms. H_2O. $Pb(NO_3)_2$.	d_{20} of Sat. Sol.	Gms. per 100 Gms. H_2O. $Cu(NO_3)_2$.	Gms. per 100 Gms. H_2O. $Pb(NO_3)_2$.
0	55.11	1.419	37.96	13.08
7.7	39.34	1.354	60.32	8.19
15.04	27.80	1.322	83.11	5.37
24.63	19.05	1.321	100.29	3.53
33.25	14.70	1.343	127.70*	2.33*

* Solid phase in contact with this solution = $Pb(NO_3)_2 + Cu(NO_3)_2.6H_2O$.

LEAD SUCCINATE, $PbC_4H_4O_4$.

SOLUBILITY IN WATER AND IN ALCOHOL.

(Partheil and Hübner, 1903.)

100 gms. H_2O dissolve 0.0253 gm. $PbC_4H_4O_4$ at 18°, and 0.0285 gm. at 25°. 100 gms. 95% alcohol dissolve 0.00275 gm. $PbC_4H_4O_4$ at 18°, and 0.003 gm. at 25°.

Density of alcohol used = 0.8092.

SOLUBILITY OF LEAD SUCCINATE IN WATER.

(Cantoni and Diotalevi, 1905.)

t°.	10°.	21°.	32°.	39°.	50°.
Gms. $PbC_4H_4O_4$ per 100 cc. sat. sol.	0.015	0.019	0.024	0.027	0.029

LEAD SULFATE $PbSO_4$.

SOLUBILITY IN WATER.

(Average curve from gravimetric results of Dibbits (1874), Beck and Stegmüller (1910) and Pleissner (1907) and conductivity results of Böttger (1903) and Kohlrausch (1904–05).

t°.	Gms. $PbSO_4$ per Liter.	t°.	Gms. $PbSO_4$ per Liter.
0	0.028	20	0.041
5	0.031	25	0.045
10	0.035	30	0.049
15	0.038	35	0.052
18	0.040	40	0.056

Results considerably higher than the above are reported by Sehnal (1909). This author finds 0.082 gm. $PbSO_4$ per liter at 18° and claims that the presence of H_2SO_4 in the $PbSO_4$ reduces the solubility very greatly. His results for the solubility in presence of small amounts of H_2SO_4 are:

Gms. H_2SO_4 per 1000 cc. solution	0	0.0098	0.0196	0.0980	0.4900	0.9800
Gms. dissolved $PbSO_4$ per 1000 cc. solution at 20°	0.082	0.051	0.025	0.013	0.006	0

Sehnal also gives results showing that the solubility in water and dilute H_2SO_4 solutions is exactly the same at 100° as at 20°.

Data for the solubility of $PbSO_4$ precipitates are given by deKoninck, 1907.

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM ACETATE AND OF SODIUM ACETATE.

(Noyes and Whitcomb, 1905, Dunnington and Long, 1899; Dibbits, 1874.)

In Ammonium Acetate. At 25° (N. and W.).				In Sodium Acetate. At 100° (D. and L.).		(D.).	
Millimols per Liter.		Gms. per Liter		G. $NH_4C_2H_3O_2$ per 100 cc. Solution.	G. $PbSO_4$ per 100 g. Solution.	Gms. per 100 Gms. H_2O.	
$NH_4C_2H_3O_2$.	$PbSO_4$.	$NH_4C_2H_3O_2$.	$PbSO_4$.			$NaC_2H_3O_2$.	$PbSO_4$.
0	0.134	0	0.041	28	7.12	2.05	0.054
103.5	2.10	7.98	0.636	32	9.88	8.2	0.853
207.1	4.55	15.96	1.38	37	10.58	41	11.23
414.1	10.10	31.92	3.02	45	11.10		

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM ACETATE AT 25°.

(Marden, 1916.)

Gms. per 1000 Gms. Sat. Sol.		Gms. per 1000 Gms. Sat. Sol.		d_{25} of Sat. Sol.
$NH_4C_2H_3O_2$.	$PbSO_4$.	$NH_4C_2H_3O_2$.	$PbSO_4$.	
[illegible].96	0.636	53.4	5.60	1.012
15.91	1.370	106.8	16.8	1.024
31.70	3.04	213.7	38.9	1.045

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM ACETATE AND OF SODIUM ACETATE AT 25°. (Fox, 1909.)

In Aq. Potassium Acetate. Gms. per 100 Gms. Sat. Sol. CH_3COOK.	$(CH_3COO)_2Pb$.	Solid Phase.	In Aq. Sodium Acetate. Gms. per 100 Gms. Sat. Sol. CH_3COONa.	$(CH_3COO)_2Pb$.	Na_2SO_4.	Solid Phase.
4.33	2.54	$PbSO_4+PbK_2(SO_4)_2$	6.69	0.78	0.34	$PbSO_4$
9.03	3.55	"	6.95	0.81	0.35	"
17.81	5.43	"	11.76	2.73	1.26	"
26.58	9.83	"	16.90	5.70	2.49	"
28.82	11.40	"	19.92	8.24	3.60	"
28.93	19.41	"	21.51	10.75	4.68	"

In the case of the CH_3COOK solutions, the double salt $PbK_2(SO_4)_2$ is formed and no SO_4 ions enter the solution.

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC AND OF NITRIC ACIDS AND OF SODIUM CHLORIDE.
(Beck and Stegmüller, 1910)

In Aqueous HCl. Normality of HCl.	Milligrams Pb per 100 cc. Solution. At 18°.	At 25°.	At 37°.	In Aq. HNO_3 at 18°. Normality of HNO_3.	Mgm. Pb per 100 cc. Sol.	In Aq. NaCl at 18°. Normality of NaCl.	Mgm. Pb per 100 cc. Sol.
0(=pure H_2O)	2.60	3	3.80	0.1	10.48	0.1	11.19
0.1	19	22.18	28.04	0.2	17.48	0.2	18.73
0.2	35.70	42.88	54.50	0.3	23.41	0.3	26.51
0.3	55.37	65.15	84.04	0.4	29.84	0.4	33.76
0.4	75.27	88.80	111.90				

SOLUBILITY OF LEAD SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 18°. (Pleissner, 1907.)
(See also Sehnal, preceding page.)

Gms. per Liter. H_2SO_4.	$PbSO_4$.	Millimols per Liter. H_2SO_4	$PbSO_4$.	Gms per Liter. H_2SO_4.	$PbSO_4$.	Millimols per Liter. H_2SO_4.	$PbSO_4$.
0	0.0382	0	0.126	0.0245	0.0194	0.25	0.064
0.0049	0.0333	0.05	0.110	0.0490	0.0130	0.50	0.043
0.0098	0.0306	0.10	0.101	0 4904	0.0052	5	0.017

SOLUBILITY OF LEAD SULFATE IN CONCENTRATED AQUEOUS SOLUTIONS OF ACIDS.
(Schultz, 1861; Rodwell, 1862)

In Aq. H_2SO_4. (a)	(b)	(c)	In Aq. HCl. (a)	(b)	(c)	In Aq. HNO_3. (a)	(b)	(c)
1.540	63.4	0.003	1.05	10.6	0.14	1.08	11.6	0.33
1.793	85.7	0.011	1.08	16.3	0.35	1.12	17.5	0.59
1.841	97	0.039	1.11	22	0.95	1.25	34	0.78
			1.14	27.5	2.11	1.42	60	1.01
			1.16	31.6	2.86			

(a) Sp. Gr. of Aq. Acid. (b) Gms. Acid per 100 Gms. Solution. (c) Gms. $PbSO_4$ per 100 Gms. Solvent.

SOLUBILITY OF LEAD SULFATE IN CONC. SOLUTIONS OF SULFURIC ACID.
(Donk, 1916.)

t°.	Gms. per 100 Gms. Sat Sol. H_2SO_4.	$PbSO_4$.	Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol. H_2SO_4.	$PbSO_4$.	Solid Phase.
0	51.2	0	$PbSO_4$	100	61.2	0	$PbSO_4$
0	89.4	0	" $+H_2SO_4.H_2O$	100	72.5	0.1	"
0	97	0	H_2SO_4	100	96.3	0.2	"
0	97.2	0.3	" $+PbSO_4$	100	99.1	0.9	"
50	50.4	0	$PbSO_4$	200	79	0	"
50	86.7	0.1	"	200	88.8	0.1	"
50	95.1	0.2	"	200	95.5	0.3	"
50	99.3	0.6	"	200	98.9	1.1	"

Additional data for highly concentrated solutions of H_2SO_4 are given by Ditz and Kanhaüser (1916).

SOLUBILITY OF BASIC LEAD SULFATES IN WATER AT 18°.

(Pleissner, 1907.)

Compound.	Formula.	One Liter Sat. Solution Contains: Mg. Lead Salt =	Mg. Pb =	Millimols Pb.
½ Basic Lead Sulfate	$PbSO_4.PbO$	13.4	10.6	0.050
¾ Basic Lead Sulfate	$PbSO_4.3PbO.H_2O$	26.2	22	0.106

LEAD PerSULFATE $Pb(SO_4)_2$.

SOLUBILITY IN AQUEOUS SULFURIC ACID AT 22°.

(Dolezalek and Finckli, 1906)

Gms. per Liter. H_2SO_4.	Gms. per Liter. $Pb(SO_4)_2$.	Solid Phase.	Gms per Liter. H_2SO_4.	Gms per Liter. $Pb(SO_4)_2$.	Solid Phase.
948	0	$PbOSO_4.H_2O$	1253	14.85	$PbOSO_4.H_2O$
1014	0.719	"	1352	16.17	"
1081	1.198	"	1470	9.30	$Pb(SO_4)_2$
1098	1.557	"	1532	9.46	"
1130	2.115	"	1631	19.80	"
1180	5.749	"	1698	33.34	"
1217	9.303	"	1703	35.22	"

The solid phase at concentrations of acid up to 1352 gms. per liter is the white basic salt of the composition $PbOSO_4.H_2O$. In the concentration limits of about 1470–1703 gms. H_2SO_4 per liter the original yellow color of the solid phase remains unchanged.

Freezing-point data (solubility, see footnote, p. 1) for mixtures of $PbSO_4+Li_2SO_4$, $PbSO_4 + K_2SO_4$ and $PbSO_4 + Na_2SO_4$ are given by Calcagni and Mariotta (1912). Results for mixtures of $PbSO_4 + K_2SO_4$ are also given by Grahmann, 1913.

LEAD (Hypo)SULFATE.

SOLUBILITY OF MIXTURES OF LEAD HYPOSULPHATE AND STRONTIUM HYPOSULPHATE AT 25°.

(Fock — Z. Kryst. Min. 28, 389, '97.)

Mol. per cent in Solution. $PbS_2O_6.4H_2O$.	Mol. per cent in Solution. $SrS_2O_6.4H_2O$.	Grams per Liter. PbS_2O_6	Grams per Liter. SrS_2O_6.	Sp. Gr. of Solutions.	Mol. per cent in Solid Phase. $PbS_2O_6.4H_2O$.	Mol. per cent in Solid Phase. $SrS_2O_6.4H_2O$.
0.0	100.0	0.0	145.6	1.1126	0 0	100.0
1.05	98.95	2.97	151.2	1.1184	0.30	99 7
15.31	84.69	40.82	152.5	1.1503	3 87	96.13
46.80	53.20	149.2	114 5	1 2147	9.84	90.16
62.30	37.70	256 1	85 0	1.2889	19.26	80.74
75.75	24.25	310.3	67.0	1.3252	23.73	76.27
78.09	21.91	373.7	70.8	1.3726	32.24	67.76
88.29	11.71	509.5	45.6	1.4671	49.97	50.13
100.0	0.00	374.3	0.0	1.6817	0.00	0.00

LEAD SULFIDE PbS.

One liter H_2O dissolves $3.6.10^{-6}$ gm. Mols. = 0.00086 gm. PbS at 18°. (Weigel, 1907.) Determined by conductivity method. See also Bruner and Zawadzki (1909).

Fusion diagrams for $PbS + ZnS$ and $PbS + Ag_2S$ are given by Friedrich (1908). Results for $PbS + Sb_2S_3$ are given by Wagemmann (1912).

LEAD SULFONATES.

SOLUBILITY IN WATER.

Name.	Formula.	t°.	Gms Salt per 100 Gms. H_2O.	Authority.
Lead 2.5 Diiodobenzenesulfonate	$C_{12}H_6O_6I_4S_2Pb.4H_2O$	20	0.77	(Boyle, 1909)
Lead β Naphthalene Sulfonate	$(C_{10}H_7SO_3)_2Pb.H_2O$	25	0.4	(Witte, '15; Euwes, '09.)
" α " "	$(C_{10}H_7SO_3)_2Pb.2H_2O$	24 9	4.195	(Euwes, 1909.)
Lead 2 Phenanthrene Monosulfonate	$1H_2O$	20	0.014	(Sandquist, 1912.)
" 3 " "	$3H_2O$	20	0.08	"
" 10 " "	$4H_2O$	20	0.14	"

LEAD TARTRATE $PbC_4O_6H_4$.

SOLUBILITY IN WATER.

(Cantoni and Zachoder — Bull. soc. chim. [3] 33, 751, '05; Partheil and Hübner — Archiv. Pharm. 241, 413, '03.)

t°.	Gms. $PbC_4O_6H_4$ per 100 cc. Solution.	t°.	Gms. $PbC_4O_6H_4$ per 100 cc. Solution.	t°.	Gms. $PbC_4O_6H_4$ per 100 cc. Solution.
18	0.010 (P. and H.)	50	0.00225	70	0.0032
25	0.0108 "	55	0.00295	75	0.0033
35	0.00105	60	0.00305	80	0.0038
40	0.0015	65	0.00315	85	0.0054

NOTE. — The positions of the decimal points here shown are just as given in the original communications.

100 gms. alcohol of 0.8092 Sp. Gr. (about 95%) dissolve 0.0028 gm. $PbC_4O_6H_4$ at 18°, and 0.00315 gm. at 25°. (P. and H.)

LECITHIN $C_{42}H_{84}NPO_9$.

100 gms. of sat. solution in aqueous 5% bile salts contain 4.5 gms. lecithin at 15°-20° and 7 gms. at 37°. Lecithin is practically insoluble in water.
(Moore, Wilson and Hutchinson, 1909.)

LEUCINE $CH_3(CH_2)_3CH(NH_2)COOH$.

100 cc. H_2O dissolve 2.2 gms. leucine at 18°.

100 cc. alcohol dissolve 0.06 gm. leucine at 17°.

Data for the solubility of leucine in aqueous solutions of salts at 20° are given by Würgler, 1914, and Pfeiffer and Würgler, 1916.

LIGNOCERIC ACID.

Data for the freezing-points (solubility, see footnote, p. 1) of mixtures of lignoceric acid and other compounds are given by Meyer, Brod and Soyka, 1913.

LIGRÖIN.

100 cc. H_2O dissolve 0.341 cc. ligröin at 22°, Vol. of solution = 100.34, Sp. Gr. 0.9969.

100 cc. ligröin dissolve 0.335 cc. H_2O at 22°, Vol. of solution = 100.60, Sp. Gr. 0.6640. (Herz, 1898.)

LITHIUM Li.

One gm. atom Li dissolves in 3.93 gm. mols. NH_3 at −80°, at −50°, at −25°, and at 0°. (Ruff and Geisel, 1906.)

LITHIUM ACETATE $CH_3COOLi.2H_2O$.

Freezing-point data for mixtures of lithium acetate and acetic acid are given by Vasilev, 1909.

LITHIUM SulfoANTIMONATE $Li_3SbS_4.10H_2O$.

SOLUBILITY IN WATER AND IN AQUEOUS ALCOHOL.

In Water. (Donk, 1908.) — In Aqueous Alcohol at 10° and 30°.

t°.	Gms. Li_3SbS_4 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	Gms. per 100 Gms. Sat. Sol. Li_3SbS_4.	Solid Phase.	Authority.
−1.7	7.1	Ice	10	10.7	41.8	$Li_3SbS_4.10H_2O$	(Donk, 1908.)
−3.2	12.8	"	10	26.2	36.5	"	"
−5.1	17.5	"	10	66.2	20.6	"	"
−10.8	23.2	"	30	13.3	46.3	$Li_3SbS_4.8\frac{1}{2}H_2O$	(Schreinemakers and Jacobs, 1910.)
−15.9	28.5	"	30	51.9	30.7	"	
−26.2	35.3	"	30	54.8	29.9	"	
−42	40.4	Ice+$Li_3SbS_4.10H_2O$	30	58.4	30.8	"	
0	45.5	$Li_3SbS_4.10H_2O$	30	58.6	32.3	" +Li_3SbS_4	
+10	46.9	"	30	65.26	29.31	Li_3SbS_4	
30	50.1	"	30	74.3	24.1	"	
50	51.3	"	30	79.5	20.5	"	

LITHIUM BENZOATE C_6H_5COOLi.

SOLUBILITY IN AQUEOUS ALCOHOL SOLUTIONS AT 25°.

(Seidell, 1910.)

Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. C_6H_5COOLi per 100 Gms. Sat. Sol.	Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. C_6H_5COOLi per 100 Gms. Sat. Sol.
0	1.103	27.64	60	0.970	19.80
10	1.088	28.60	70	0.932	15.40
20	1.072	28.50	80	0.890	10.70
30	1.052	27.80	90	0.847	6.40
40	1.030	26.20	95	0.823	4.50
50	1.003	23.60	100	0.799	2.60

100 gms. H_2O dissolve about 40 gms. C_6H_5COOLi at the b. pt. (U. S. P.)
100 gms. alcohol dissolve about 10 gms. C_6H_5COOLi at the b. pt. "

LITHIUM BORATE $Li_2OB_2O_3$.

SOLUBILITY IN WATER.

t°	0	10	20	30	40	45
Gms. $Li_2OB_2O_3$ per 100 Gms. H_2O	0.7	1.4	2.6	4.9	11.12	20

(Le Chatelier, 1897.)

EQUILIBRIUM IN THE SYSTEM LITHIUM OXIDE, BORIC OXIDE, WATER AT 30°.

(Dukelski, 1907.)

Gms. per 100 Gms. Sat Sol.		Solid Phase.	Gms. per 100 Gms Sat Sol.		Solid Phase.
Li_2O.	B_2O_3.		Li_2O.	B_2O_3	
7.01	...	$LiOH\ H_2O$	1.32	3.36	$Li_2O.2B_2O_3.xH_2O$
7.51	2.98	"	0.86	2.47	"
7.71	3.38	" $+Li_2O.B_2O_3.16H_2O$	0 53	2.47	"
7.68	3.56	$Li_2O\ B_2O_3\ 16H_2O$	2.17	13.12	"
5.40	2.78	"	2 61	16.39	"
3.47	2.42	"	5.08	30.81	$Li_2O.5B_2O_3.10H_2O$
2.94	2.51	"	4.10	27.07	"
1.58	3.27	"	3.22	15.40	"
2.17	6.90	"	1.55	15.40	"
3.66	14.78	"	1.30	14.14	"
5.25	22	"	0.96	11.47	$B(OH)_3$
5.63	23.8	"	0.63	4 85	"
1.81	6.20	$Li_2O.2B_2O_3\ xH_2O$	0	3.54	"

Freezing-point data (solubility, see footnote, p. 1) for mixtures of $LiBO_2$ + $NaBO_2$, and $LiBO_2$ + Li_2SiO_3 are given by van Klooster, 1910–11.

LITHIUM BROMATE $LiBrO_3$.

100 gms. H_2O dissolve 153.7 gms. $LiBrO_3$ at 18°, or 100 gms. saturated solution contain 60.4 gms. Sp. Gr. of sol. = 1.833. (Mylius and Funk, 1897.)

LITHIUM BROMIDE $LiBr.2H_2O$.

SOLUBILITY IN WATER.

(Kremers, 1858, Bogorodsky, 1894; Jones, 1907)

t°.	Gms. LiBr per 100 Gms. H_2O.	Solid Phase.	t°.	Gms LiBr per 100 Gms. H_2O.	Solid Phase.
− 0.46	1.058	Ice (J)	10	166	$LiBr\ 2H_2O$ (K)
− 1.94	4.274	"	20	177	"
− 4.27	8.678	"	30	191	"
−10.3	17.80	"	40	205	"
−30.5	37.64	"	44	209	" $+LiBr.H_2O$ (B)
−45	50	" $+LiBr.3H_2O$	50	214	$LiBr.\ H_2O$ (K)
−30	80	$LiBr.3H_2O$	60	224	"
−10	122	"	80	245	"
0	143	" (K)	100	266	"
+ 4	160	" $+LiBr\ 2H_2O$ (B)	159	...	$LiBr.H_2O+LiBr$ (B)

Freezing-point data for LiBr + LiOH (Scarpa, 1915), for LiBr + AgBr. (Sandonnini and Scarpa, 1913.)

100 gms. glycol dissolve 60 gms. LiBr at 14.7°. (de Coninck, 1905.)

DiLITHIUM *d* CAMPHORATE $C_{10}H_{14}O_4Li_2$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF CAMPHORIC ACID AT 13.5°–16° AND VICE VERSA.

(Jungfleisch and Landrieu, 1914.)

Gms. per 100 Gms. Sat. Sol. $C_8H_{14}(COOH)_2$.	$C_{10}H_{14}O_4Li_2$.	Solid Phase.	
0.621	0	Camphoric Acid	$C_8H_{14}(COOH)_2$
2.02	3.77	" "	"
3.25	10.63	Monolithium Tetracamphorate	$C_{10}H_{15}O_4Li.3C_{10}H_{16}O_4$
3.51	12.61	" "	"
3.99	20.56	" Dicamphorate	$C_{10}H_{15}O_4.Li.C_{10}H_{16}O_4$
3.43	24.69	" "	"
2.87	37.16	" Camphorate	$C_{10}H_{15}O_4Li$
0	40.80	Dilithium Camphorate	$C_{10}H_{14}O_4Li_2$

The mixtures were kept in a cellar at nearly constant temperature and shaken from time to time until equilibrium was reached. Additional results at 17°–23° are also given.

LITHIUM CARBONATE Li_2CO_3.

SOLUBILITY IN WATER.

(Bevade, 1885; Fluckiger, 1887; Draper, 1887)

An average curve was constructed from the available results and the following table read from it.

t°.	Gms. Li_2CO_3 per 100 Gms. Water.	Solution.	t°.	Gms. Li_2CO_3 per 100 Gms. Water	Solution.
0	1.54	1.52	40	1.17	1.16
10	1.43	1.41	50	1.08	1.07
20	1.33	1.31	60	1.01	1.00
25	1.29	1.28	80	0.85	0.84
30	1.25	1.24	100	0.72	0.71

Density of saturated solution at 0° = 1.017; at 15° = 1.014.

SOLUBILITY OF LITHIUM CARBONATE IN AQUEOUS SOLUTIONS OF ALKALI SALTS AT 25°.

(Geffcken — Z. anorg. Chem. 43, 197, '05.)

The original results were calculated to gram quantities and plotted on cross-section paper. The figures in the following table were read from the curves.

Gms. Salt per Liter.	Grams Li_2CO_3 per Liter in Aqueous Solutions of: $KClO_3$.	KNO_3.	KCl.	NaCl.	K_2SO_4.	Na_2SO_4.	NH_4Cl.	$(NH_4)_2SO_4$.
0	12.63	12.63	12.63	12.63	12.63	12.63	12.63	12.63
10	12.95	13.05	13.10	13.4	13.9	14.0	16.0	20.7
20	13.10	13.3	13.5	13.9	14.7	15.0	19.2	25.0
30	13.25	13.6	13.8	14.3	15.4	16.0	21.5	28.2
40	13.40	13.8	14.0	14.6	16.0	16.6	23.3	30.8
60	...	13.8	14.2	14.5	16.9	17.8	26.0	35.2
80	...	13.6	14.0	14.4	17.7	18.6	27.6	38.5
100	...	13.5	13.9	14.2	18.2	19.4	28.4	41.0
120	...	13.3	13.7	14.0	...	19.9	28.7	42.6
140	...	13.0	13.3	...	...	20.4	28.8	43.5
170	...	12.6	...	...	...	...	28.9	...
200	...	12.2	...	...	...	...	29.0	...

100 gms. aq. alcohol of 0.941 Sp. Gr. dissolve 0.056 gm. Li_2CO_3 at 15.5°.

One liter sat. sol. in water contains 0.1722 gm. mols. = 12.73 gms. Li_2CO_3 at 25°. (Ageno and Valla, 1911.)

SOLUBILITY OF LITHIUM CARBONATE IN AQUEOUS SOLUTIONS OF ORGANIC COMPOUNDS AT 25°.

(Rothmund, 1908, 1910; see also Traube, 1909)

The solubility in H_2O = 0.1687 mols. Li_2CO_3 per liter = 12.47 gms. at 25°.

Aqueous Solution of:	Gm. Mols. Li_2CO_3 per Liter in Aq. Solution of:			
	0.125 Normality.	0.25 Normality.	0.5 Normality.	1 Normality.
Methyl Alcohol	...	0.1604	0.1529	0.1394
Ethyl Alcohol	0.1614	0.1555	0.1417	0.1203
Propyl Alcohol	0.1604	0.1524	0.1380	0.1097
Amyl Alcohol (tertiary)	0.1564	0.1442	0.1224	0.0899
Acetone	0.1600	0.1515	0.1366	0.1104
Ether	0.1580	0.1476	0.1300	...
Formaldehyde	0.1668	0.1653	0.1606	0.1531
Glycol	0.1660	0.1629	0.1565	0.1472
Glycerol	0.1670	0.1647	0.1613	0.1532
Mannite	0.1705	0.1737	0.1778	...
Grape Sugar	0.1702	0.1728	0.1752	0.1778
Cane Sugar	0.1693	0.1689	0.1661	0.1557
Urea	0.1686	0.1673	0.1643	0.1605
Thiourea	0.1667	0.1643	0.1600	0.1523
Dimethylpyrone	0.1562	0.1460	0.1280	0.0992
Ammonia	0.1653	0.1630	0.1577	0.1466
Diethylamine	0.1589	0.1481	0.1283	0.0937
Pyridine	0.1592	0.1503	0.1347	0.1091
Urethan	0.1604	0.1525	0.1377	0.1113
Acetamide	...	0.1614	0.1520	0.1358
Acetonitrile	0.1618	0.1556	0.1429	0.1178
Mercuricyanide	0.1697	0.1704	...	...

Freezing-point data for mixtures of $Li_2CO_3 + Li_2SO_4$ (Amadori, 1912.)
$Li_2CO_3 + K_2CO_3$. (Le Chatelier, 1894.)

LITHIUM (Bi) CARBONATE $LiHCO_3$.

100 gms. H_2O dissolve 5.501 gms. $LiHCO_3$ at 13°. (Bevade, 1884.)

LITHIUM CHLORATE $LiClO_3$.

100 gms. H_2O dissolve 213.5 gms. $LiClO_3$ at 18°, or 100 gms. sat. solution contain 75.8 gms. Sp. Gr. of sol. = 1.815. (Mylius and Funk, 1897.)

100 gms. H_2O dissolve 483 gms. $LiClO_3$ at 15°, d_{15} of sat. sol. = 1.82. (Carlson, 1910.)

LITHIUM CHLORAURATE $LiAuCl_4$.

SOLUBILITY IN WATER.

(Rosenbladt, 1886.)

t°.	Gms. $LiAuCl_4$ per 100 Gms. Solution.	t°.	Gms. $LiAuCl_4$ per 100 Gms. Solution.	t°.	Gms. $LiAuCl_4$ per 100 Gms. Solution.
10	53.1	40	67.3	60	76.4
20	57.7	50	72	70	81
30	62.5			80	85.7

LITHIUM CHLORIDE LiCl.

SOLUBILITY IN WATER. (Average curve from results of Gerlach, 1869.)

t°.	Gms. LiCl per 100 Gms. Water.	Gms. LiCl per 100 Gms. Solution.	t°.	Gms. LiCl per 100 Gms. Water.	Gms. LiCl per 100 Gms. Solution.
0	67	40.1	40	90.5	47.5
10	72	41.9	50	97	49.2
20	78.5	44	60	103	51.9
25	81.5	44.9	80	115	53.5
30	84.5	45.8	100	127.5	56

Density of saturated solution at 0°, 1.255; at 15°, 1.275.

SOLUBILITY OF LITHIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID.

Results at 0°. (Engel, 1888.) Gms. per 100 cc. Sat. Sol. LiCl.	HCl.	d_0 of Sat. Sol.	Results at 25°. (Herz, 1911–12.) Gms per 100 cc. Sat. Sol. LiCl.	HCl.
51	0	1.255	57.4	0
41.4	8.2	1.243	56.87	2.30
28.5	24.1	1.249	53.64	3.84
24.6	29.5	1.251	51.98	6.43

SOLUBILITY OF LITHIUM CHLORIDE IN AQUEOUS SOLUTIONS OF ALCOHOL AT 25°.
(Pinar de Rubies, 1913–1914)

The LiCl was determined by titration with $AgNO_3$. Solutions saturated by constant agitation for many hours. Solid phase, $LiCl.H_2O$ for all mixtures. The anhydride, LiCl, separates only from the most highly concentrated alcohol solutions.

Gms. per 100 Gms Sat Sol. C_2H_5OH.	LiCl.	Gms per 100 Gms. Sat. Sol. C_2H_5OH.	LiCl.
0	44.9	50	25.75
10	40.9	60	21.6
20	37.25	70	21.1
30	33.3	75	20.8
40	29.4	80	20.75

SOLUBILITY OF LITHIUM CHLORIDE IN ETHYL ALCOHOL AT DIFFÉRENT TEMPERATURES. (Turner and Bissett, 1913)

t°.	Gms. LiCl per 100 Gms. C_2H_5OH.	Solid Phase.	t°.	Gms. LiCl per 100 Gms. C_2H_5OH.	Solid Phase.
0	14.42	$LiCl.4C_2H_5OH$	20	24.28	LiCl
5	15.04	"	30	25.10	"
10	16.77	"	40	25.38	"
15	18.79	"	50	24.40	"
17	20.31	"	60	23.46	"

SOLUBILITY OF LITHIUM CHLORIDE IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. LiCl per 100 Gms. Solvent.	Authority.	Solvent.	t°.	Gms. LiCl per 100 Gms. Solvent.	Authority.
Alcohol:				Alcohol:			
Methyl	25	42.36	(Turner & Bissett, 1913.)	Amyl	25	9.03	(Turner & Bissett, 1913.)
Ethyl	25	2.54*	(Patten & Mott, 1904.)	"	?	7.2	(Andrews & Ende, 1895.)
Propyl	25	16.22	(Turner & Bissett, 1913.)	"	25	9*	(Patten & Mott, 1907.)
"	?	15.86	(Schlamp, 1894)	Butyl	25	10.57*	" "
"	25	3.86*	(Patten & Mott, 1904.)	Glycerol	25	4.32*	" "
Allyl	25	4.38*	" "	Phenol	53	1.93*	" "

* Fused LiCl used for these determinations.

100 cc. anhydrous hydrazine dissolve 16 gms. LiCl at room temp.
(Welsh and Broderson, 1915.)

Solubility of Lithium Chloride in Several Solvents.

(Laszczynski, 1894; deConinck, 1905.)

In Acetone. (L.)				In Pyridine. (L.)		In Glycol. (de C.)	
t°.	Gms. LiCl per 100 Gms. $(CH_3)_2CO$.	t°.	Gms. LiCl per 100 Gms. $(CH_3)_2CO$.	t°.	Gms. LiCl per 100 Gms. C_5H_5N.	t°.	Gms. LiCl per 100 Gms. Sat. Sol.
0	4.60	46	3.76	15	7.78	15	11
12	4.41	53	3.12	100	14.26		
25	4.11	58	2.14				

Solubility of Lithium Chloride in Pyridine.

(Kahlenberg and Krauskopf, 1908.)

In Anhydrous Pyridine.				In 97% Pyridine + 3% H_2O by Volume.		
t°.	Gms. LiCl per 100 Gms. Sat. Sol.	Gms. LiCl per 100 Gms. Solvent.	Solid Phase.	t°.	Gms LiCl per 100 Gms. Sat. Sol.	Gms LiCl per 100 Gms. Solvent.
8	11.31	12.71	$LiCl.2C_5H_5N$	22	12.50	14.31
28	11.87	13.47	"	32	13.79	15.98
40	11.60	13.10	$LiCl.C_5H_5N$	45	15.58	18.46
60	11.38	12.84	"	58	16.72	20.08
80	11.71	13.27	"	72	17.12	20.66
100	13.01	14.98	"	97	18.35	22.48

tr. temp. about 28°.

Solubility of Lithium Chloride at 25° in Mixtures of:

Acetone and Benzene. (Marden and Dover, 1917)				Ethyl Acetate and Benzene. (Marden and Dover, 1917.)	
Gms Acetone per 100 Gms Solvent.	Gms LiCl per 100 Gms. Solvent.	Gms Acetone per 100 Gms. Solvent.	Gms LiCl per 100 Gms. Solvent.	Gms Ethyl Acetate per 100 Gms. Solvent.	Gms LiCl per 100 Gms. Solvent.
100	2.30	40	0.088	100	1.78
90	1.69	20	0.019	90	0.147
80	0.966	10	0.009	80	0.028
60	0.234	0	0	70	0.005

Distribution of Lithium Chloride Between Water and Amyl Alcohol at 30°.

(Dhar and Datta, 1913)

Mols. LiCl per Liter. H_2O Layer c_1.	Mols. LiCl per Liter. Alcohol Layer c_2.	$\frac{c_1}{c_2}$.	Mols LiCl per Liter. H_2O Layer c_1.	Mols LiCl per Liter. Alcohol Layer c_2.	$\frac{c_1}{c_2}$.
3.24	0.0347	93.37	2.68	0.0240	111.66
3.06	0.0325	94.15	2.58	0.0275	113.40
2.93	0.0300	97.70	2.34	0.0200	117
2.82	0.0275	102.58	1.84	0.0125	147.2
2.76	0.0250	110.40	0.65	0.0030	216.66

Freezing-point data (solubility, see footnote, p. 1) are given for the following mixtures of lithium chloride and other compounds.

Lithium Chloride	+ Lithium Hydroxide	(Scarpa, 1915.)
"	+ Magnesium Chloride	(Sandonnini, 1913, 1914.)
"	+ Manganese Chloride	(Sandonnini and Scarpa, 1913.)
"	+ Potassium Chloride	(Richards and Meldrum, 1917.)
"	+ " " + NaCl	(Richards and Meldrum, 1917.)
"	+ Rubidium Chloride	(Richards & Meldrum,'17; Zemcznzny & Rambach,'10.)
"	+ Silver Chloride	(Sandonnini, 1911a, 1914.)
"	+ Sodium Chloride	(Zemcznzny and Rambach, 1910.)
"	+ Strontium Chloride	(Sandonnini, 1911, 1911a, 1914.)
"	+ Thallium Chloride	(Sandonnini, 1911, 1914.)
"	+ Tin Chloride (ous)	(Rack, 1914.)

LITHIUM CHROMATE $Li_2CrO_4.2H_2O$.

LITHIUM BICHROMATE $Li_2Cr_2O_7.2H_2O$.

SOLUBILITY IN WATER AT 30°.

(Schreinemaker — Z. physik. Chem. 55, 79, '06; at 18°, Mylius and Funk — Ber. 30, 1718, '97.)

Composition in Weight per cent: Of Solution. % CrO_3.	% Li_2O.	Of Residue. % CrO_3.	% Li_2O.	Solid Phase.
0.0	7.09	...	...	$LiOH.H_2O$
6.986	7.744	4.322	18.538	"
16.564	8.888	10.089	19.556	"
25.811	10.611	15.479	21.106	"
33.618	12.886	24.365	19.398	"
37.411	14.306	44.555	17.411	$LiOH.H_2O + Li_2CrO_4.2H_2O$
37.588	14.381	36.331	18.552	" "
37.495	13.311	51.075	16.384	$Li_2CrO_4.2H_2O$
40.280	10.858	...	...	"
43.404	11.809	53.793	14.070	$Li_2CrO_4.2H_2O + Li_2Cr_2O_7.2H_2O$
45.130	9.515	56 085	10.190	$Li_2Cr_2O_7.2H_2O$
47.945	7.951	58 029	9.238	"
57.031	6.432	65.560	8.733	"
67.731	5.713	71.687	8.513	$Li_2Cr_2O_7.2H_2O + CrO_3$
67.814	5.689	80.452	3.780	" "
65.200	4.661	...	...	CrO_3
63.257	2.141	85.914	0.758	"
62.28	...	...	...	"

A saturated aqueous solution contains:

49.985 per cent Li_2CrO_4, or 100 grams H_2O dissolve 99.94 grams Li_2CrO_4 at 30° (S.).

56.6 per cent $Li_2Cr_2O_7$, or 100 grams H_2O dissolve 130.4 grams $Li_2Cr_2O_7$ at 30° (S.).

52.6 per cent Li_2CrO_4, or 100 grams H_2O dissolve 110.9 grams $LiCrO_4$ at 18° (M. and F.).

Sp. Gr. of sat. solution at 18° = 1.574.

LITHIUM CITRATE $C_3H_4(OH)(COOLi)_3.4H_2O$.

100 gms. H_2O dissolve 61.2 gms. Li citrate at 15°. d_{15} sat. sol. = 1.187.
(Greenish and Smith, 1902.)

SOLUBILITY IN AQUEOUS ALCOHOL AT 25°.

(Seidell, 1910.)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_3H_4OH(COOLi)_3.4H_2O$ per 100 Gms. Solvent.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_3H_4OH(COOLi)_3.4H_2O$ per 100 Gms. Solvent.
0	1.216	74.50	50	0.933	4.93
10	1.150	49.30	60	0.897	2.25
20	1.083	32.10	70	0.867	0.60
30	1.025	18.80	80	0.838	0.30
40	0.976	9.65	100	0.788	0.02

LITHIUM FLUORIDE LiF.

100 gms. H_2O dissolve 0.27 gm. LiF at 18°. Sp. gr. of sol. = 1.003.
(Mylius and Funk, 1897.)

F.-pt. data for LiF + LiOH and for LiOH + LiI are given by Scarpa, 1915.

LITHIUM FORMATE HCOOLi.

SOLUBILITY IN WATER.
(Groschuff, 1903.)

t°.	Gms. HCOOLi per 100 Gms. Solution.	Mols. HCOOLi per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. HCOOLi per 100 Gms. H_2O.	Mols. HCOOLi per 100 Mols. H_2O.	Solid Phase.
−20	21.14	9.28	$HCOOLi.H_2O$	91	54.16	40.90	$HCOOLi.H_2O$
0	24.42	11.18	"	98	57.05	45.99	HCOOLi
18	27.85	13.36	"	104	57.64	47.11	"
49.5	35.60	19.14	"	120	59.63	51.13	"
74	44.91	28.22	"				

Sp. gr. sat. sol. at 18° = 1.142.

SOLUBILITY OF NEUTRAL LITHIUM FORMATE IN ANHYDROUS FORMIC ACID.
(Groschuff, 1903.)

t°.	Gms. HCOOLi per 100 Gms. Solution.	Mols. HCOOLi per 100 Mols. HCOOH.	Solid Phase.
0	25.4	30	HCOOLi
18	25.9	30.9	"
39	26.4	31.75	"
60	26.9	32.6	"
79	27.8	34	"

LITHIUM HIPPURATE $C_6H_5CO.NHCH_2COOLi$.

100 gms. H_2O dissolve about 40 gms. of the salt at 15–20°.
(Squire and Caines, 1905.)

LITHIUM HYDROXIDE $LiOH.H_2O$.

SOLUBILITY IN WATER.
(Dittmar, 1888; Pickering, 1893.)

t°.	Gms. per 100 Gms. Solution Li_2O	= LiOH	Gms. LiOH per 100 Gms. H_2O.	t°.	Gms. per 100 Gms. Solution. Li_2O	= LiOH.	Gms. LiOH per 100 Gms. H_2O.
−10.5	...	7.23	...	30	7.05	11.27	12.9
−18 Eutec.	...	11.2	...	40	7.29	11.68	13
0	6.67	10.64	12.7	50	7.56	12.12	13.3
10	6.74	10.80	12.7	60	7.96	12.76	13.8
20	6.86	10.99	12.8	80	8.87	14.21	15.3
25	6.95	11.14	12.9	100	10.02	16.05	17.5

SOLUBILITY OF LITHIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF LITHIUM SULFOANTIMONATE AT 30° AND VICE VERSA.
(Donk, 1908.)

Gms. per 100 Gms. Sat. Sol. LiOH.	Li_3SbS_4.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. LiOH.	Li_3SbS_4.	Solid Phase.
11.4	0	$LiOH.H_2O$	2.1	48.3	$LiOH.H_2O$
9.1	8.3	"	2.1	52.1	" $+Li_3SbS_4.10H_2O$
2.3	29.9	"	1.4	51.8	$Li_3SbS_4.10H_2O$
			0	51.3	"

Data for equilibrium in the system lithium hydroxide, phenol, water at 25° are given by van Meurs, 1916.

LITHIUM IODATE $Li(IO_3).\frac{1}{2}H_2O$.

100 gms. H_2O dissolve 80.3 gms. $LiIO_3$ at 18°, or 100 gms. solution contain 44.6 grams. Sp. gr. of sol. = 1.568. (Mylius and Funk, 1897.)

LITHIUM IODIDE $LiI.3H_2O$.

SOLUBILITY IN WATER.

(Kremers, 1858, 1860; ice curve, Jones, 1907.)

t°.	Gms. per 100 Gms Water.	Gms. per 100 Gms Sat. Sol.	Solid Phase.	t°.	Gms per 100 Gms. Water.	Gms per 100 Gms. Sat. Sol.	Solid Phase.
−0.296	1.08	1.06	Ice	20	165	62 2	$LiI.3H_2O$
−1.218	4 36	4 19	"	25	167	62.6	"
−2.70	8 71	8 02	"	30	171	63 1	"
− 6.14	17 69	15.03	"	40	179	64 2	"
−16.2	38 31	27 70	"	50	187	65.2	"
−25	48 67	32 72	"	60	202	66 9	"
−59	85.13	46	"	70	230	69.7	"
−69 Eutec.	93	48 2	Ice+$LiI.3H_2O$	75	263	72.5	"
−60	100	50	$LiI.3H_2O$	75	m. pt.	...	"
−40	118	54 13	"	85	m. pt.	...	$LiI.2H_2O$
−20	134	57 27	"	80	435	81 3	$LiI.H_2O$
0	151	60 2	"	100	481	82 8	"
10	157	61 1	"	120	590	85.5	"

SOLUBILITY OF LITHIUM IODIDE IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. LiI per 100 Gms. Solvent.	Authority.
Methyl Alcohol	25	343.4	(Turner and Bissett, 1913.)
Ethyl Alcohol	25	250.8	" "
Propyl Alcohol	25	47.52*	" "
Amyl Alcohol	25	112.5	" "
Glycol	15.3	38.9	(de Coninck, 1905.)
Furfurol	25	45.9†	(Walden, 1906.)
Nitromethane	0	1.22†	"
"	25	2.52	"

* Solid phase = $LiI.4C_3H_7OH$. † = gms per 100 cc. sat. solution.

F.-pt. data for LiI + AgI are given by Sandonnini and Scarpa, 1913.

LITHIUM IODOMERCURATE $2LiI.HgI_2.6H_2O$.

100 gms. sat. solution of lithium iodomercurate in water prepared by cooling a hot solution and allowing to stand at 24.7° for 3 months, contained 1.30 gms. Li, 27.4 gms. Hg, 58 gms. I and 13.3 gms. H_2O; Sp. Gr. of the sat. sol. = 3.28. (Duboin, 1905.)

LITHIUM LAURATE, MYRISTATE, etc.

SOLUBILITY IN WATER AND IN ALCOHOL OF $d = 0.797$, AT 18° AND AT 25°.

(Partheil and Ferie, 1903)

Salt.	Formula.	Gms. Salt per 100 cc. Sat. Solution in: Water at 18°.	Water at 25°.	Alcohol at 18°.	Alcohol at 25°.
Stearate	$C_{17}H_{35}COOLi$	0.010	0.011	0.041	0.0532
Palmitate	$C_{15}H_{31}COOLi$	0.011	0.018	0.0796	0.0956
Myristate	$C_{13}H_{27}COOLi$	0.0232	0.0234	0.184	0.2100
Laurate	$C_{11}H_{23}COOLi$	0.158	0.1726	0.418	0.4424
Oleate	$C_{17}H_{33}COOLi$	0.0674	0.1320	0.9084	1.010

LITHIUM LAURATE, MYRISTATE, PALMITATE and STEARATE.

SOLUBILITY OF EACH OF THESE SALTS, DETERMINED SEPARATELY, IN SEVERAL SOLVENTS.

(Jacobson and Holmes, 1916.)

Li laurate = $C_{11}H_{23}COOLi$. Li myristate = $C_{13}H_{27}COOLi$, Li palmitate = $CH_3(CH_2)_{14}COOLi$ and Li stearate = $CH_3(CH_2)_{16}COOLi$.

Excess of salt shaken with solvent for 2 hrs. in all cases. The sat. sol. was analyzed by evaporating to dryness and weighing residue.

Solvent.	t°.	Gms. of Each Salt (determined separately) per 100 Gms. Solvent.			
		Li Laurate.	Li Myristate.	Li Palmitate.	Li Stearate.
Abs. Ethyl Alcohol	20	0.403	0.194	0.096	0.072
" "	25.4	0.447	0.224	0.118	0.089
" "	35	0.546	0.278	0.142	0.106
" "	50	0.782	0.435	0.248	0.200
" "	65	1.149	0.669	0.391	0.333
Methyl Alcohol	15.2	3.159	1.346	0.616	0.349
" "	25	3.773	1.680	0.771	0.439
" "	34.6	4.597	2.193	1.086	0.658
" "	50	6.088	3.281	1.652	1.057
Water	16.3	0.154	0.027	0.010	0.009
"	25	0.187	0.036	0.015	0.010
"	35	0.207	0.042	0.015	0.010
"	50	0.280	0.062	...	...
Ether	15.8	0.011	0.013	0.007	0.011
"	25	0.006	0.004	0.007	0.011
Amyl Alcohol	16	0.073	0.029	0.019	0.011
" "	25.7	0.111	0.046	0.032	0.028
" "	35	0.126	0.062	0.033	0.031
" "	49.2	0.203	0.109	0.069	0.060
Chloroform	15.2	0.006	0.004	0.004	0.004
Amyl Acetate	14.5	0.068	0.037	0.038	0.034
" "	25	0.064	0.034	0.024	0.029
" "	35	0.061	0.044	0.037	0.031
" "	50	0.061	0.045	0.036	0.044
Methyl Acetate	24.5	0.026	0.013	0.015	0.012
Acetone	15	0.300	0.413	0.434	0.571
"	25	0.376	0.447	0.508	0.706
"	35	0.430	0.502	0.537	0.663

The above lithium salts were prepared by adding the calculated amount of lithium acetate to the alcoholic solutions of the respective fatty acids. The resulting precipitates were dissolved in boiling alcohol and the solutions allowed to stand over night in a cool place. The salts so obtained were washed and dried.

LITHIUM TetraMOLYBDATE $Li_2O.MoO_3.2H_2O$.

100 cc. sat. aqueous solution contain 43.13 gms. $Li_2O.MoO_3.2H_2O$ at 20°. d_{20} of sat. sol. = 1.44. (Wempe, 1912.)

LITHIUM NITRATE $LiNO_3.3H_2O$.

SOLUBILITY IN WATER. (Donnan and Burt, 1903.)

t°.	Gms. $LiNO_3$ per 100 Gms. Solution.	Solid Phase.	t°.	Gms. $LiNO_3$ per 100 Gms. Solution.	Solid Phase.
0.1	34.8	$LiNO_3.3H_2O$	29.87	56.42	$LiNO_3.3H_2O$
10.5	37.9	"	29.86	56.68	"
12.1	38.2	"	29.64	57.48	"
13.75	39.3	"	29.55	58.03	"
19.05	40.4	"	43.6	60.8	$LiNO_3.\frac{1}{2}H_2O$
22.1	42.9	"	50.5	61.3	"
27.55	47.3	"	55	63	"
29.47	53.67	"	60	63.6	"
29.78	55.09	"	64.2	64.9	$LiNO_3$
			70.9	66.1	"

The eutectic Ice $+ LiNO_3.3H_2O$, is at $-17.8°$ and about 33 gms. $LiNO_3$ per 100 gms. sat. sol. Transition points, 29.6° and 61.1°.

Data for the system $LiNO_3 + Li_2SO_4 + H_2O$ at 0°, 30° and 70° are given by Massink, 1916.

A sat. solution of lithium nitrate in acetone contains 0.343 gm. mols. = 23.67 gms. per liter at about 20°. (Roshdestwensky and Lewis, 1911.)

Freezing-point data for $LiNO_3 + KNO_3$ and $LiNO_3 + NaNO_3$ are given by Carveth, 1898. Results for $LiNO_3 + KNO_3$ are also given by Harkins and Clark, 1915.

Results for $LiNO_3 + Li_2SO_4$ are given by Amadori, 1913.

LITHIUM NITRITE $LiNO_2.H_2O$.

SOLUBILITY IN WATER. (Oswald, 1914.)

t°.	Gms. $LiNO_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t.	Gms. $LiNO_2$ per 100 Gms. Sat. Sol.	Solid Phase.
− 7.5	11.1	Ice	38.5	55.5	$LiNO_2.H_2O$
−11.7	15	"	42	56.9	"
−21	21.2	"	49	60.6	"
−28.8	29	"	49.5	61.2	" $+LiNO_2.\frac{1}{2}H_2O$
−31.3	29.4	" $+LiNO_2.H_2O$	65	63 8	$LiNO_2.\frac{1}{2}H_2O$
−19.3	33.9	$LiNO_2.H_2O$	81.5	68.7	"
0	41.5	"	91	72.4	"
+19	48.9 (d_{19}=1 3186.)	"	96	91.8	"
25	50.9	"	92.5	94.3	"

100 gms. H_2O dissolve 10.5 gms. $AgNO_2$ + 78.5 gms. $LiNO_2$ at 14°. (Oswald, 1914.)

LITHIUM OXALATE $Li_2C_2O_4$.

SOLUBILITY OF MIXTURES OF LITHIUM OXALATE AND OXALIC ACID IN WATER AT 25°. (Foote and Andrew, 1905)

Mixtures of the two substances were dissolved in water, and the solutions cooled in a thermostat to 25°.

Gms. per 100 Gms. Solution.		Mols. per 100 Mols. H_2O.		Solid Phase.
$H_2C_2O_4$.	$Li_2C_2O_4$.	$H_2C_2O_4$.	$Li_2C_2O_4$.	
10.20	...	2.274	...	$H_2C_2O_4.2H_2O$
10.66	2.96	2.457	0.622	$H_2C_2O_4.H_2O$ and $HLiC_2O_4.H_2O$
10.55	3.11			
8.08	3.18	1.823	0.633	Double Salt $HLiC_2O_4.4H_2O$ $= 39.2H_2C_2O_4$ and $44.7Li_2C_2O_4$
2.60	5.03	0.563	0.962	
2.16	6.54	0.469	1.273	$HLiC_2O_4.H_2O$ and $Li_2C_2O_4$
2.12	1.61			
	5.87	...	1.901	$Li_2C_2O_4$

100 gms. aqueous solution, simultaneously saturated with lithium oxalate and ammonium oxalate at 25°, contain 5.75 gms. $Li_2C_2O_4$ + 4.8 gms. $(NH_4)_2C_2O_4$. (Foote and Andrew, 1905.)

LITHIUM PHOSPHATE Li_3PO_4.

100 gms. H_2O dissolve 0.04 gm. Li_3PO_4. (Mayer, 1856.)

LITHIUM (Hypo) **PHOSPHATE** $Li_4P_2O_6.7H_2O$.

100 gms. H_2O dissolve 0.83 gm. hypophosphate at ord. temp. (Rammelsberg, 1892.)

LITHIUM PERMANGANATE $LiMnO_4.3H_2O$

100 gms. water dissolve 71.4 gms. permanganate at 16°. (Ashoff.)

LITHIUM SALICYLATE $C_6H_4OHCOOLi.\frac{1}{2}H_2O$.

SOLUBILITY IN AQUEOUS ALCOHOL SOLUTIONS AT 25°.

(Seidell, 1909, 1910)

Gms. C_2H_5OH per 100 Gms. Solvent.	d_{25} of Sat. Sol.	Gms. $C_6H_4OHCOOH\frac{1}{2}H_2O$ per 100 Gms. Sat Sol.	Gms. C_2H_5OH per 100 Gms. Solvent.	d_{25} of Sat. Sol.	Gms. $C_6H_4OHCOOH\frac{1}{2}H_2O$ per 100 Gms. Sat. Sol.
0	1.209	56	60	1.104	51.1
10	1.195	55.9	70	1.083	49.5
20	1.180	55.4	80	1.056	47.5
30	1.163	54.7	90	1.026	45.8
40	1.144	53.7	92.3	1.020	45.6
50	1.124	52.5	100	1.027	48.2

100 gms. propyl alcohol dissolve 18.7 gms. Li salicylate (temp.?). (Schlamp, 1895)

LITHIUM SULFATE $Li_2SO_4.H_2O$.

SOLUBILITY IN WATER.

(Average curve from Kremers, 1855; Etard, 1894)

t°.	Gms. Li_2SO_4 per 100 Gms. Solution.	t°.	Gms Li_2SO_4 per 100 Gms. Solution.	t°.	Gms. Li_2SO_4 per 100 Gms. Solution.
−20	18.4	20	25.5	50	24.5
−10	24.2	25	25.3	60	24.2
0	26.1	30	25.1	80	23.5
10	25.9	40	24.7	100	23

SOLUBILITY OF LITHIUM-POTASSIUM SULFATE IN WATER.

(Spielrein, 1913)

t°.	Gms. per 100 cc. Sat. Sol. Li_2SO_4.	K_2SO_4.	Solid Phase.	t°.	Gms. per 100 cc. Sat. Sol. Li_2SO_4	K_2SO_4.	Solid Phase.
20	35.6	3.6	$Li_2SO_4.K_2SO_4+Li_2SO_4$	60	10 6	16.3	$Li_2SO_4.K_2SO_4+K_2SO_4$
20	13.3	13.1	" $+K_2SO_4$	98	30.2	9.3	" $+Li_2SO_4$
60	32.5	6	" $+Li_2SO_4$	98	9	23	" $+K_2SO_4$

SOLUBILITY OF LITHIUM-SODIUM SULFATES IN WATER.

(Spielrein, 1913)

t°.	Gms. per 100 cc. Sat. Sol Li_2SO_4.	Na_2SO_4.	Solid Phase.	t°.	Gms. per 100 cc. Sat Sol. Li_2SO_4	Na_2SO_4	Solid Phase.
0	31.4	5 9	$Li_2SO_4.Na_2SO_4.5\frac{1}{2}H_2O+Li_2SO_4$	33.5	25 8	13.9	$Li_2SO_4\ Na_2SO_4\ 3H_2O+Li_2SO_4$
0	18.5	11.4	" " $+Na_2SO_4$	33.5	13.9	21.8	" $+Na_2SO_4$
7.5	20.4	11 17	" (triple pt)	53	28	16 6	" $+Li_2SO_4$
16	32	9.3	" "	53	16.7	27.3	" $+Na_2SO_4$
24	26	14.9	$Li_2SO_4.Na_2SO_4\ 12H_2O+Li_2SO_4$	99	27.4	14 4	" $+Li_2SO_4$
24	16.5	21.4	" $+Na_2SO_4$	99	14.4	25.1	" $+Na_2SO_4$
32	20	16.8	" (triple pt)				

There is some uncertainty as to whether all of the above results are in terms of grams per 100 cc. or per 100 gms. of sat. solution.

SOLUBILITY OF LITHIUM SULFATE IN ABSOLUTE SULFURIC ACID.

(Bergius, 1910)

10 cc. sat. solution in abs. H_2SO_4 contain 2.719 gms. Li_2SO_4 and the crystalline solid phase has the composition $Li_2SO_4.7H_2SO_4$ and melts at about 12°.

SOLUBILITY OF LITHIUM SULFATE IN AQ. H_2SO_4 AT 30°. (van Dorp, 1910.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
H_2SO_4.	Li_2SO_4.		H_2SO_4.	Li_2SO_4.	
5.05	22.74	$Li_2SO_4.H_2O$	55.08	13.69	$LiSO_4$
12.23	20.45	"	61.46	17.10	"
16.60	19.10	"	62.49	18.89	$Li_2SO_4.H_2SO_4$
32.70	13.37	"	69.40	13.75	"
42.98	10.57	"	78.23	11.64	"
52.72	11.44	"	83.43	15.65	"

SOLUBILITY OF LITHIUM SULFATE IN AQUEOUS ALCOHOL AT 30°.
(Schreinemakers and van Dorp, Jr., 1906.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms per 100 Gms Sat. Sol.		Solid Phase.
C_2H_5OH.	Li_2SO_4.		C_2H_5OH.	Li_2SO_4.	
0	25.1	$Li_2SO_4.H_2O$	47.28	3.04	$Li_2SO_4.H_2O$
11.75	16.16	"	58.59	1.22	"
21.19	11.52	"	69.39	0.396	"
29.40	8.17	"	80.74	0	"
33.31	6.66	"	94.11	0	"

F.-pt. data for $Li_2SO_4 + MnSO_4$ are given by Calcagni and Marotta, 1914: Results for $Li_2SO_4 + SrSO_4$ are given by Calcagni and Marotta, 1912. Results for $Li_2SO_4 + Na_2SO_4$ and $Li_2SO_4 + K_2SO_4$ are given by Nacken, 1907; results for $Li_2SO_4 + Ag_2SO_4$ are given by Nacken, 1907b.

LITHIUM SILICATE Li_2SiO_3.

Fusion point data for $Li_2O + SiO_2$ and $Li_2SiO_3 + ZnSiO_3$ are given by van Klooster, 1910–11. Results for $Li_2SiO_3 + MgSiO_3$, $Li_2SiO_3 + Na_2SiO_3$, $Li_2SiO_3 + K_2SiO_3$ and $Li_2SiO_3 + SrSiO_3$ are given by Wallace, 1909.

LITHIUM TARTRATES.

SOLUBILITY IN WATER.

Salt.	Formula.	t°.	Gms. Salt per 100 Gms. Sat. Sol.	Authority.
Lithium Dihydroxytartrate	$Li_2C_4H_4O_8.2\frac{1}{2}H_2O$	0	0.079	(Fenton, 1898.)
Lithium Sodium Racemic Tartrate	$LiNaC_4H_4O_6.2H_2O$	20	19 97	(Schlossberg, 1900.)
" " Dextro "	"	20	22.55	"
" Potassium Racemic "	$LiKC_4H_4O_6.H_2O$	20	35 19	"
" " Dextro "	"	20	37.82	"

MAGNESIUM Mg. F.-pt. data for Mg+Hg. (Cambi and Speroni, 1915)

MAGNESIUM ACETATE $Mg(CH_3COO)_2.4H_2O$.

EQUILIBRIUM IN THE SYSTEM MAGNESIUM OXIDE–ACETIC ACID–WATER AT 25°.
(Iwaki, 1914)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
CH_3COOH.	MgO.		CH_3COOH.	MgO.	
3.36	1.73	MgO	31.37	7.99	$(CH_3COO)_2Mg.4H_2O$
5.65	2.93	"	36.23	8.18	" +2.3.3
8.06	4.21	"	35.77	8.17	2.3.3
12.46	6.54	"	40.87	7.42	"
15.46	8.24	" $+(CH_3COO)_2Mg.4H_2O$	47.86	6.74	"
15.38	8.31	$(CH_3COO)_2Mg.4H_2O$	56.16	5.81	"
14.25	7.24	"	61.59	4.68	"
20.19	7.47	"	69.13	3.75	"
22.93	7.60	"	75.93	2.85	"
26.61	7.74	"	82.90	2.23	"

2.3.3 = $2(CH_3COO)_2Mg.3CH_3COOH.3H_2O$. More careful work in the region of the double salt showed that a second double salt of the composition $5(CH_3COO)_2Mg.10CH_3COOH.7H_2O$ was obtained. This compound usually separated from the more concentrated acetic acid solutions.

MAGNESIUM BENZOATE $Mg(C_6H_4COO)_2.4H_2O$.

100 gms. H_2O dissolve 6.16 gms. $Mg(C_6H_5COO)_2$ at 15° and 19.6 gms. at 100°. (Tarugi and Checchi, 1901.)

100 gms. H_2O dissolve 3.33 gms. $Mg(C_6H_5COO)_2$ at 15–20. (Squire and Caines, 1905.)

MAGNESIUM BROMATE $Mg(BrO_3)_2.6H_2O$.

100 cc. sat. solution contain 42 grams $Mg(BrO_3)_2$, or 0.15 gram mols. at 18°.

(Kohlrausch — Sitzb. K. Akad. Wiss. (Berlin), i, 90, '97.)

MAGNESIUM BROMIDE $MgBr_2.6H_2O$.

SOLUBILITY IN WATER.

(Menschutkin — Chem. Centrb. 77, I, 646, '06; at 18°, Mylius and Funk — Ber. 30, 1718, '97.)

t°	Grams $MgBr_2$ per 100 Gms. Solution.	Water.	t°.	Grams $MgBr_2$ per 100 Grams. Solution.	Water.
−10	47.2	89.4	40	50.4	101.6
0	47.9	91.9	50	51.0	104.1
10	48.6	94.5	60	51.8	107.5
18	49.0	96.1	80	53.2	113.7
18	50.8	103.4 (M. and F.)	100	54.6	120.2
20	49.1	96.5	120	56.0	127.5
25	49.4	97.6	140	58.0	138.1
30	49.8	99.2	160	62.0	163.1

Density of saturated solution at 18° = 1.655 (M. and F.)

Etard — Ann. chim. phys. [7] 2, 541, '94, gives solubility results which are evidently too high.

MAGNESIUM BROMIDE ETHERATES, ALCOHOLATES, ACIDATES, ETC.

SOLUBILITIES RESPECTIVELY IN ETHER, ALCOHOL, ACIDS, ETC., AT VARIOUS TEMPERATURES.

(Boris N. Menschutkin Monograph in the Russian language entitled "On Etherates and Other Molecular Combinations of Magnesium Bromide and Iodide" St Petersburg, 1907, pp 267 and XLVIII. Also published in the Memoirs of the St. Petersburg Polytechnic Institute, Vols. 1–7, 1904–1907, and in condensed form in Vols. 49–62 of the Zeit. anorg Chem , 1906–1909)

Preparation of Material. The dietherate of magnesium bromide, $MgBr_2.2(C_2H_5)_2O$ (Z. anorg. Chem., 49, 34, '06) was prepared by the very gradual addition of bromine to a cold mixture of magnesium powder and dry ether. It is very hygroscopic and is stable only under its ethereal solution. It is decomposed by water and reacts with very many organic compounds as alcohols, acids, ketones, esters, aldehydes, etc. The addition products thus formed constitute the material employed in the author's succeeding studies. The monoetherate of magnesium bromide, $MgBr_2.(C_2H_5)_2O$, was prepared just as the dietherate, but the temperature during crystallization was kept above 30°, at which point the dietherate is converted to monoetherate. It is also precipitated by dry ligröin.

Method of Determination of Solubility. At temperatures below 30° the determinations were made by agitating an excess of the salt with the solvent and analyzing the saturated solution. At the higher temperatures the synthetic (sealed tube) method of Alexejeff (Wied. Ann., 1885) was used.

See also p. 391.

SOLUBILITY OF MAGNESIUM BROMIDE DIETHERATE, $MgBr_2.2(C_2H_5)_2O$, AND OF MAGNESIUM BROMIDE ETHERATE, $MgBr_2(C_2H_5)_2O$, IN ETHYL ETHER, $(C_2H_5)_2O$, AT VARIOUS TEMPERATURES.

(Menschutkin. See preceding page.)

Solubility of the Dietherate in Ether.

t°.	Gms. per 100 Gms Sat Sol. $MgBr_2.2(C_2H_5)_2O$.	Gms. per 100 Gms Sat Sol. $MgBr_2$.	Mols. $MgBr_2.2(C_2H_5)_2O$ per 100 Mols. Sat. Sol.
−8	1.08	0.6	0.24
0	1.44	0.8	0.32
+10	2.3	1.27	0.52
14	2.95	1.64	0.67
16	3.48	1.93	0.80
18	4.14	2.3	0.96
20	4.86	2.7	1.125
22.8	6.3	3.5	1.6
Two liquid layers separate between these concentrations of $MgBr_2\ 2(C_2H_5)_2O$.			
23	72.3	40.1	36.8
24	75.3	41.8	40.5
26	79.5	44.1	46.6
28.5	84.2	46.7	54.2
30	85.5	47.4	56.9

Solubility of the Monoetherate in Ether.

t°.	Gms. per 100 Gms. Sat. Sol. $MgBr_2.(C_2H_5)_2O$.	Gms. per 100 Gms. Sat. Sol. $MgBr_2$.	Mols. $MgBr_2.(C_2H_5)_2O$ per 100 Mols. Sat. Sol.
0	68.8	49.1	28.1
20	67.2	47.9	27.1
30	66.5	47.3	26.6
40	65.5	46.7	26.1
60	63.8	45.5	25.1
80	62.1	44.3	24.2
100	60.7	43.3	23.5
120	59.6	42.5	22.9
140	58.5	41.7	22.3
158	57.5	41	21.9
Two liquid layers separate between these concentrations of $MgBr_2.(C_2H_5)_2O$.			
158	5.8	4.15	1.6
158	4.8	3.4	1.36
159	1.96	1.4	0.56
162	0.38	0.27	0.11
170	0.18	0.13	0.05

At 22.8° and 158° the saturated solutions of the dietherate and monoetherate, respectively, separate into two liquid layers which have at the intervening temperatures the following composition. Determinations of the specific gravity of the lower layer gave $d_{17} = 1.1628$ and $d_{30} = 1.1492$.

t°.	Gms per 100 Gms. Solution. Lower Layer. $MgBr_2\ 2(C_2H_5)_2O$.	Lower Layer. $MgBr_2$.	Upper Layer. $MgBr_2.2(C_2H_5)_2O$.	Upper Layer. $MgBr_2$.	
−10	75.75	42	3.2	1.8	unstable
0	73.9	41	4.1	2.3	"
+10	72.2	40.1	5	2.8	"
20	70.8	39.3	5.9	3.3	stable
30	69.8	38.7	6.8	3.8	
40	68.8	38.2	7.7	4.3	
50	68	37.8	8.5	4.7	
60	67.7	37.6	9.2	5.1	
70	67.7	37.6	9.7	5.4	
80	68	37.8	10	5.6	
90	68.6	38.1	10.2	5.7	
100	69.4	38.5	10.4	5.8	
120	71	39.3	10.1	5.6	
140	72.4	40.15	9.2	5.1	
158	74	41	7.8	4.3	

SOLUBILITY OF ETHYL, METHYL, PROPYL, ETC., ALCOHOLATES OF MAGNESIUM BROMIDE IN THE RESPECTIVE ALCOHOLS. (Menschutkin, 1907)

These compounds were all prepared by the action of magnesium bromide dietherate upon the several alcohols. The ether was expelled and the new alcoholate addition product recrystallized from the respective alcohol. The solubility determinations were made by the synthetic method.

Solubility of $MgBr_2.6CH_3OH$ in Methyl Alcohol.

t°.	Gms. $MgBr_2.6CH_3OH$ per 100 Gms. Sat. Sol.
0	42.6
20	44.6
40	46.7
60	48.9
80	51.4
100	55.5
120	60.7
140	66.8
160	74
180	84.5
185	88
190 m. pt.	100

Solubility of $MgBr_2.6C_2H_5OH$ in Ethyl, Alcohol.

t°.	Gms $MgBr_2.6C_2H_5OH$ per 100 Gms. Sat. Sol.
0	17.2
10	24.9
20	32.7
30	40.3
40	47.8
60	62.2
80	73.8
90	78.7
100	86.7
103	90
106	94.4
108.5 m. pt.	100

Solubility of $MgBr_2.6C_3H_7OH$ in Propyl Alcohol.

t°.	Gms. $MgBr_2.6C_3H_7OH$ per 100 Gms. Sat. Sol.
0	77.9
10	81.5
20	85.1
30	88.5
40	92
43	93
46	94.3
48	95.8
50	97.8
52 m. pt.	100

Solubility of $MgBr_2.6 Iso C_4H_9OH$ in IsoButyl Alcohol.

t°.	Gms $MgBr_2.6C_4H_9OH$ per 100 Gms Sat. Sol
0	55.8
10	60.5
20	65.2
30	69.8
40	74.3
50	78.5
60	82.4
65	84.2
71	88
75	92
77	94.6
80 m. pt.	100

Solubility of $MgBr_2.6 Iso C_5H_{11}OH$ in IsoAmyl Alcohol.

t°.	Gms. $MgBr_2.6C_5H_{11}OH$ per 100 Gms. Sat Sol.
0	70.2
10	75.6
20	80.2
30	84.5
35	86.7
38	88.7
40	90
42	92
44	94.2
46 m. pt.	100

Solubility of $MgBr_2.4(CH_3)_2CHOH$ in Dimethyl Carbinol.

t°.	Gms $MgBr_2.4(CH_3)_2CHOH$ per 100 Gms. Sat. Sol.
0	40
20	42.2
40	45
60	48.5
80	53.3
100	59
120	67.3
130	74
136	83.6
138	90
139 m. pt.	100

Solubility of $MgBr_2.4(CH_3)_3COH$ in Trimethyl Carbinol.

t°.	Gms $MgBr_2.4(CH_3)_3COH$ per 100 Gms. Sat Sol
24.7 m pt of $(CH_3)_3COH$	
24.4 Eutec.	0.06
25	1
35	9.5
45	19.1
55	32.2
60	40.5
70	62.5
75	77
79	91.5
80 m. pt.	100

MAGNESIUM BROMIDE ANILINATES.

SOLUBILITY OF MAGNESIUM BROMIDE ANILINATES IN ANILINE AT DIFFERENT TEMPERATURES. (Menschutkin, 1907)

The compounds were formed by the action of aniline on magnesium bromide dietherate. The three compounds were: $MgBr_2.6C_6H_5NH_2$, $MgBr_2.4C_6H_4NH_2$ and $MgBr_2.2C_6H_5NH_2$.

t°.	Gms. $MgBr_2.4C_6H_5NH_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $MgBr_2.4C_6H_5NH_2$ per 100 Gms. Sat. Sol.	Solid Phase.
10	3.2	$MgBr_2.6C_6H_5NH_2$	160	26	$MgBr_2.4C_6H_5NH_2$
50	5.1	"	180	28.3	"
70	7.5	"	200	33.5	"
90	12.8	"	220	45	"
100	18.5	"	230	55	"
103.5	27.5	"	237 tr. pt.	76.3	"
103 tr. pt.	24	$MgBr_2.4C_6H_5NH_2$	250	77.3	$MgBr_2.2C_6H_5NH_2$
120	24.3	"	260	78.1	"
140	24.3	"	270	79	"

MAGNESIUM BROMIDE PHENYLHYDRAZINATES.

SOLUBILITY OF MAGNESIUM BROMIDE. PHENYLHYDRAZINATES IN PHENYLHYDRAZINE.

(Menschutkin, 1907.)

(Approximate determinations.)

t°.	Gms. $MgBr_2.6C_6H_5NHNH_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $MgBr_2.6C_6H_5NHNH_2$ per 100 Gms. Sat. Sol.	Solid Phase.
20	3	$MgBr_2.6C_6H_5NHNH_2$	100 tr. pt.	54.8	$MgBr_2.4C_6H_5NH.NH_2$
40	7	"	140	60.8	"
60	16.4	"	180	68.4	"
80	33	"	200	73.4	"
99	54.8	"			"

MAGNESIUM BROMIDE COMPOUNDS with Benzaldehyde and with Acetone.

SOLUBILITY RESPECTIVELY IN BENZALDEHYDE AND IN ACETONES.

(Menschutkin, 1907.)

The compounds were prepared by the action of benzaldehyde and of acetone on magnesium bromide dietherate. On account of the nature of the compounds the results are only approximately correct.

Solubility of $MgBr_2.3C_6H_5COH$ in Benzaldehyde. Solubility of $MgBr_2.3CH_3.CO.CH_3$ in Acetone.

t°.	Gms $MgBr_2.3C_6H_5COH$ per 100 Gms. Sat. Sol.	t°.	Gms $MgBr_2.3C_6H_5COH$ per 100 Gms. Sat Sol	t°.	Gms $MgBr_2.3CH_3COCH_3$ per 100 Gms. Sat. Sol.	t°.	Gms. $MgBr_2.3CH_3COCH_3$ per 100 Gms. Sat. Sol.
0	0.7	140	17.8	0	0.2	75	50
30	1.3	145	37.5	30	0.8	76	71.6
60	1.9	146	65	60	1.45	80	83.3
100	3.4	148	84.5	70	2	84	89.8
120	6	153	93.2	73	5.5	88	95.2
130	9.5	159 m pt.	100	74	14	92 m. pt.	100

MAGNESIUM BROMIDE COMPOUNDS with Methylal, Ortho Ethylformate, Formic Acid and Acetic Acid.

(Menschutkin, 1907a.)

The compounds were prepared by the action of methylal, ortho ethylformate and absolutely dry formic and acetic acids on magnesium dietherate. In the case of the latter compounds the results are only approximately correct, due to their extreme hygroscopicity.

Solubility of $MgBr_2.2CH_2(OCH_3)_2$ in Methylal. Solubility of $MgBr_2.2CH(OC_2H_5)_3$ in Orthoethylformate. Solubility of $MgBr_2.6HCOOH$ in Formic Acid. Solubility of $MgBr_2.6CH_3COOH$ in Acetic Acid.

t°.	Gms $MgBr_2.2CH_2(OCH_3)_2$ per 100 Gms. Sat. Sol.	t°.	Gms $MgBr_2.2CH(OC_2H_5)_3$ per 100 Gms. Sat. Sol.	t°.	Gms $MgBr_2.6HCOOH$ per 100 Gms. Sat. Sol.	t°.	Gms. $MgBr_2.6CH_3COOH$ per 100 Gms. Sat. Sol.
20	0.3	0	11.1	0	49.8	17	0.3
40	0.45	20	12.5	20	57.5	30	1.5
60	0.6	40	14.8	40	65.1	50	4.5
80	0.75	60	18.6	60	73.1	60	7.9
100	0.9	80	25.7	70	78.1	70	16.2
106	1.1	90	35	80	86	80	38.5
2 liquid layers here		95	41	86	95	90	57.7
106	86.2	100	50	88 m. pt.	100	100	71.8
108	90.8	105	66			105	80
110	95.4	110	88.5			110	89.5
112 m. pt.	100	114 m. pt.	100			112 m. pt.	100

MAGNESIUM BROMIDE COMPOUNDS with Acetamide, Acetanilide and Acetic Anhydride.

(Menschutkin, 1909.)

The compounds were prepared by reaction with magnesium bromide dietherate.

Solubility of $MgBr_2.6CH_3CONH_2$ in Acetamide.

t°.	Gms. $MgBr_2.6CH_3CONH_2$ per 100 Gms. Sat. Sol.	Solid Phase.
82	m. pt. of CH_3CONH_2	CH_3CONH_2
80	3.1	"
70	21.7	"
60	40	"
50.5*	56	$CH_3CONH_2+MgBr_2.CH_3CONH_2$
70	57.8	$MgBr_2.CH_3CONH_2$
90	60.5	"
110	65	"
130	71.5	"
150	80	"
160	85	"
165	90	"
169†	100	"

Solubility of $MgBr_2.6CH_3CONHC_6H_5$ in Acetanilide.

t°.	Gms. $MgBr_2.6CH_3CONHC_6H_5$ per 100 Gms. Sat. Sol.	Solid Phase.
112	m. pt. of $CH_3CONHC_6H_5$	
110	3.7	$CH_3CONHC_6H_5$
108	7.7	"
107.5*	9	" $+MgBr_2.CH_3CONHC_6H_5$
120	13.1	$MgBr_2.CH_3CONHC_6H_5$
140	19.3	"
160	25.5	"
180	35.3	"
200	59.5	"
205	73.2	"
207	82.5	"
209	100†	"

Solubility of $MgBr_2.6(CH_3CO)_2O$ in Acetic Anhydride.

t°.	Gms. $MgBr_2.6(CH_3CO)_2O$ per 100 Gms. Sat. Sol.
0	26.4
20	28.7
40	31.6
60	35.7
80	41.1
100	48.4
120	57.8
130	69.8
133	77
135	85
136.5†	100

* Eutec. † m. pt.

MAGNESIUM BROMIDE COMPOUNDS with Urethan and with Urea.

(Menschutkin, 1909.)

Solubility of Magnesium Bromide Urethan Compounds in Urethan.

t°.	Gms $MgBr_2.4C_2H_5OCONH_2$ per 100 Gms. Sat. Sol.	Solid Phase.
49	m. pt. of urethan	$C_2H_5OCONH_2$
45	18.5	"
39	36.5	"
35*	43.3	" $+MgBr_2.6C_2H_5OCONH_2$
50	45.6	$MgBr_2.6C_2H_5OCONH_2$
70	51.3	"
80	56.2	"
90	66.5	"
91.5	75.5	"
91†	69.4	" $+MgBr_2.4C_2H_5OCONH_2$
100	73.8	$MgBr_2.4C_2H_5OCONH_2$
110	80	"
115	84.1	"
120	90	"
123	100	"

Solubility of Magnesium Bromide Urea Compounds in Urea.

t°.	Gms $MgBr_2.4CO(NH_2)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
132	m. pt. of urea	$CO(NH_2)_2$
126	9.5	"
120	17.2	"
114	21.8	"
108.5*	24.2	$CO(NH_2)_2+MgBr_2.6CO(NH_2)_2$
115	29.8	$MgBr_2.6CO(NH_2)_2$
120	35	"
127	45.5	"
130	60	"
130†	58	" $+MgBr_2.4CO(NH_2)_2$
145	60.7	$MgBr_2.4CO(NH_2)_2$
160	67.2	"
165	71.4	"
170	83.7	"
171	96	"

* Eutec. † tr. pt.

MAGNESIUM CAMPHORATE $C_{10}H_{14}O_4Mg.14H_2O$.

SOLUBILITY OF MAGNESIUM CAMPHORATE IN *d* CAMPHORIC ACID AT 15° AND VICE VERSA.

(Jungfleisch and Landrieu, 1914.)

Gms. per 100 Gms. Sat. Sol. $C_{10}H_{16}O_4$.	$C_{10}H_{14}O_4Mg$.	Solid Phase.	Gms. per 100 Gms Sat. Sol. $C_{10}H_{16}O_4$.	$C_{10}H_{14}O_4Mg$.	Solid Phase.
0.622 (13.5°)	0	$C_{10}H_{16}O_4$	3.16	10.30	$C_{10}H_{16}O_4$
1.20	1.29	"	3.5	16.5	" $+C_{10}H_{14}O_4Mg.14H_2O$
1.98	3.53	"	3.6	16.7	$C_{10}H_{14}O_4Mg.14H_2O$
2.36	5.66	"	1.91	15.1	"
2.85	8.19	"	0	14.25	"

MAGNESIUM CARBONATE $MgCO_3.3H_2O$.

SOLUBILITY IN WATER IN PRESENCE OF CARBON DIOXIDE AT 15°.

(Treadwell and Reuter — Z. anorg. Ch. 17, 200, '98.)

cc. CO_2 per 100 cc. Gas Phase (at 0° and 760 mm.).	Partial Pressure of CO_2 in mm. Hg.	Grams per 100 cc. Solution.			
		Free CO_2.	$MgCO_3$.	$Mg(HCO_3)_2$.	Total Mg.
18.86	143.3	0.1190	...	1.2105	0.2016
5.47	41.6	0.0866	...	1.2105	0.2016
4.47	33.8	0.0035	...	1.2105	0.2016
1.54	11.7	...	0.0773	1.0766	0.2016
1.35	10.3	...	0.0765	0.7629	0.1492
1.07	8.2	...	0.0807	0.5952	0.1224
0.62	4.7	...	0.0701	0.3663	0.0865
0.60	4.6	...	0.0758	0.3417	0.0788
0.33	2.5	...	0.0748	0.2632	0.0655
0.21	1.6	...	0.0771	0.2229	0.0594
0.14	1.1	...	0.0710	0.2169	0.0566
0.03	0.3	...	0.0711	0.2036	0.0545
...	...	...	0.0685	0.2033	0.0536
...	...	...	0.0702	0.1960	0.0529
...	...	...	0.0625	0.2036	0.0520
...	...	...	0.0616	0.1954	0.0511
...	...	...	0.0641	0.1954	0.0518

Therefore at 0 partial pressure of CO_2 and at 15° and mean barometric pressure, one liter of saturated aqueous solution contains 0.641 gm. of $MgCO_3$ plus 1.954 gms. $Mg(HCO_3)_2$.

It is pointed out by Johnston (1915) that although Treadwell and Reuter made very painstaking analyses, their mode of working did not secure equilibrium conditions, a fact which is borne out by the lack of constancy of the calculated solubility-product constant.

SOLUBILITY OF MAGNESIUM CARBONATE IN WATER CHARGED WITH CARBON DIOXIDE AT PRESSURES GREATER THAN ONE ATMOSPHERE.

(Engel and Ville — Compt. rend. 93, 340, '81; Engel — Ann. chim. phys [6] 13, 349, '88.)

Pressure of CO_2 in Atmospheres.	G. $MgCO_3$* per Liter At 12°.	G. $MgCO_3$* per Liter At 19°.	Pressure of CO_2 in Atmospheres	G. $MgCO_3$* per Liter. At 12°.	G. $MgCO_3$* per Liter. At 19°.
0.5	20.5	...	4.0	42.8	...
1.0	26 5	25.8	4.7	...	43.5
2.0	34 2	33.1 (2.1 At.)	6.0	50.6	48.5 (6.2 At.)
3.0	39.0	37.2 (3.2 At.)	9.0	...	56.6

SOLUBILITY IN WATER SATURATED WITH CO_2 AT ONE ATMOSPHERE.

(Engel.)

t°.	Gms. $MgCO_3$* per Liter.	t°.	Gms. $MgCO_3$* per Liter.	t°.	Gms. $MgCO_3$* per Liter.
5	36	30	21	60	11
10	31	40	17	80	5
20	26			100	0

* Dissolved as $Mg(HCO_3)_2$.

Data for the system magnesium carbonate-carbonic acid-water at 20°, 25°, 30°, 34° and 39° are given by Leather and Sen (1914). In connection with these results, it is pointed out by Johnston (1915), that it is questionable whether equilibrium was really obtained and furthermore, the accuracy of the analytical results cannot be trusted since the ratio of *total* amount of CO_2 in solution, to the magnesia is very irregular. The results when plotted directly show great inconsistencies.

THE CALCULATED SOLUBILITY OF $MgCO_3.3H_2O$ IN WATER AT 18° IN CONTACT WITH AIR CONTAINING PARTIAL PRESSURES OF CO_2 FROM 0.0002 TO 0.0005 ATMOSPHERES.

(Johnston, 1915.)

It is shown that if the CO_2 pressure is kept constant at P and the water evaporated off so slowly at 18° that equilibrium conditions are continuously maintained, the following amounts of $Mg(OH)_2$ or of $MgCO_3.3H_2O$ will be obtained.

Partial Pressure P of CO_2 in Atms.	Total Mg $\frac{\text{Mols.}}{l}$.	Gms. per Liter.	
0	0.00015	0.0087	$Mg(OH)_2$
0.00020	0.01934	1.13	"
0.00025	0.02218	1.29	"
0.00030	0.02486	1.45	"
0.00035	0.02742	1.60	"
0.00040	0.02868	3.97	$MgCO_3.3H_2O$
0.00045	0.02924	4.05	"
0.00050	0.02976	4.12	"

SOLUBILITY OF MAGNESIUM CARBONATE IN NATURAL WATERS.

(Wells, 1915)

(In all cases the solutions were in equilibrium with atmospheric air at 20°.)

Mixture.	Milligrams per Liter of Sat. Solution: Mg.	Free CO_2.	CO_2 as Bi-carbonate.
Natural Magnesite in Distilled H_2O	0.018	trace	0 065
" in Aq. NaCl (27.2 g. per l.)	0.028	trace	0 086
$MgCO_3.3H_2O$ (equilibrium from bicarbonate end)	0.038	0.28 CO_2 as carbonate	0.83
$MgCO_3.3H_2O$ (" " undersaturation ")	0.034	0.32 CO_2 " "	0.59

SOLUBILITY OF MAGNESIUM CARBONATE IN AQUEOUS SOLUTIONS OF POTASSIUM BICARBONATE.

(Auerbach, 1904)

The conditions necessary for preventing changes in equilibrium due to hydrolysis and loss of CO_2 are discussed. The mixtures were shaken from 1–4 days. The sat. sol. analyzed for total alkali $\left(K + \frac{Mg}{2}\right)$ by titration with standard HCl using methyl orange as indicator. The neutralized solution was boiled to expel CO_2 and then excess 0.1 *n* NaOH added and the filtrate from magnesium precipitate back titrated with 0.1 *n* HCl. The $\frac{Mg}{2}$ was calculated from the used 0.1 *n* NaOH and the K obtained by difference.

Results at 15°. Mols. per Liter. $KHCO_3$.	$MgCO_3$.	Solid Phase.	Results at 25°. Mols per Liter $KHCO_3$.	$MgCO_3$.	Solid Phase.	Results at 35°. Mols per Liter $KHCO_3$	$MgCO_3$.	Solid Phase.
0	0.0095	$MgCO_3.3H_2O$	0	0.0087	$MgCO_3.3H_2O$	0	0.0071	$MgCO_3.3H_2O$
0.0992	0.0131	"	0.0985	0.0115	"	0.1092	0.0098	"
0.1943	0.0167	"	0.2210	0.0149	"	0.2811	0.0142	"
0.3992	0.0211	" (labil)	0.3434	0.0181	"	0.4847	0.0177	"
0.2681	0.0192	" +1.1	0.4985	0.0217	" (labil)	0.5807	0.0198	" (labil)
0.5243	0.0097	1.1	0.3906	0.0196	" +1.1	0.5088	0.0184	" +1.1
0.6792	0.0074	"	0.5893	0.0128	1.1	0.6231	0.0153	1.1
0.981	0.0028	"	0.6406	0.0117	"	0.8535	0.0119	"
			1.125	0.0061	"			

1.1 = $MgCO_3.KHCO_3.4H_2O$.

Additional data for this system are given by Nanty, 1911.

Data for the solubility of $MgCO_3$ in aq. NaCl and other salt solutions, determined by prolonged boiling and subsequent cooling of the solution out of contact with air, are given by Gothe (1915).

SOLUBILITY OF MAGNESIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM CARBONATE AT 25°. The solutions being in equilibrium with an atmosphere free from CO_2.

(Cameron and Seidell — J. Physic. Ch. 7, 588, '03.)

Wt. of 1 Liter of Solution.	Grams per Liter.		Reacting Weights per Liter.	
	Na_2CO_3.	$MgCO_3$.	Na_2CO_3.	$MgCO_3$.
996.8	0.00	0.223	0.000	0.00266
1019.9	23.12	0.288	0.220	0.00344
1047.7	50.75	0.510	0.482	0.00620
1082.5	86.42	0.879	0.820	0.01027
1118.9	127.3	1.314	1.209	0.01570
1147.7	160.8	1.636	1.526	0.01955
1166.1	181.9	1.972	1.727	0.02357
1189.4	213.2	2.317	2.024	0.02770

SOLUBILITY OF MAGNESIUM BI CARBONATE AND OF MAGNESIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT 23°. The solutions being in equilibrium with an atmosphere of CO_2 in the one case, and in equilibrium with air free from CO_2 in the other.

(C. and S.)

In Presence of CO_2 as Gas Phase.		In Presence of Air Free from CO_2.		
Gms. NaCl per Liter.	Gms. $Mg(HCO_3)_2$ per Liter.	Wt. of 1 Liter.	Gms. NaCl per Liter.	Gms. $MgCO_3$ per Liter.
7.0	30.64	996.9	0.0	0.176
56.5	30.18	1016.8	28.0	0.418
119.7	27.88	1041.1	59.5	0.527
163.9	24.96	1070.5	106.3	0.585
224.8	20.78	1094.5	147.4	0.544
306.6	10.75	1142.5	231.1	0.460
		1170.1	272.9	0.393
		1199.3	331.4	0.293

SOLUBILITY OF MAGNESIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM SULPHATE AT 24° AND AT 35.5°. The solutions being in equilibrium with an atmosphere free from CO_2.

(Cameron and Seidell)

Results at 24°.			Results at 35.5.°		
Wt. of 1 Liter.	Gms. Na_2SO_4 per Liter.	Gms. $MgCO_3$ per Liter.	Wt. of 1 Liter.	Gms. Na_2SO_4 per Liter.	Gms. $MgCO_3$ per Liter.
997.5	0.00	0.216	995.1	0.32	0.131
1021.2	25.12	0.586	1032.9	41.84	0.577
1047.6	54.76	0.828	1067.2	81.84	0.753
1080.9	95.68	1.020	1094.8	116.56	0.904
1133.8	160.8	1.230	1120.4	148.56	0.962
1157.3	191.9	1.280	1151.7	186.7	1.047
1206.0	254.6	1.338	1179.8	224.0	1.088
1242.0	305.1	1.388	1236.5	299.2	1.130

MAGNESIUM CHLORATE $Mg(ClO_3)_2.6H_2O$.

SOLUBILITY IN WATER.

(Meusser — Ber. 35, 1416, '02.)

t°.	Gms. $Mg(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Mg(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Mg(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Mg(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.
-18	51.64	10.05	$Mg(ClO_3)_2.6H_2O$	42	63.82	16.60	$Mg(ClO_3)_2.4H_2O$
0	53.27	10.73	"	65.5	69.12	20.08	"
18	56.50	12.22	"	39.5	65.37	17.76	$Mg(ClO_3)_2.2H_2O$
29	60.23	14.25	"	61.0	69.46	21.40	"
35	63.65	16.48	"	68	70.69	22.69	"
				93	(73.71)	(26.38)	"

Sp. Gr. of saturated sol. at + 18° = 1.564.

MAGNESIUM CHLORIDE $MgCl_2$.

SOLUBILITY IN WATER.

(van't Hoff and Meyerhoffer, 1898; Engel; Lowenherz. Results quoted from Landolt and Börnstein, 1912.)

t°.	Gms. $MgCl_2$ per 100 Gms Solution.	Gms. $MgCl_2$ per 100 Gms Water.	Solid Phase.	t°.	Gms. $MgCl_2$ per 100 Gms Solution.	Gms. $MgCl_2$ per 100 Gms Water.	Solid Phase.
−10	11.1	12.5	Ice	0	34.5	52.8	$MgCl_2.6H_2O$
−20	16.0	19.0	"	10	34.9	53.5	"
−30	19.4	24.0	"	20	35.3	54.5	"
−33.6	20.6	26.0	Ice + $MgCl_2.12H_2O$	22	35.6	55.2	"
−20	26.7	36.5	$MgCl_2$ $12H_2O$	25	36.2	56.7	"
−16.4	30.6	44.04 f.pt.	"	40	36.5	57.5	"
−16.8	31.6	46.2	$MgCl_2$ $12H_2O$ + $MgCl_2.8H_2O$ a	60	37.9	61.0	"
−17.4	32.3	47.6*	$MgCl_2$ $12H_2O$ + $MgCl_2$ $8H_2O\beta$	80	39.8	66.0	"
−19.4	33.3	49.9*	$MgCl_2$ $12H_2O$ + $MgCl_2$ $6H_2O$	100	42.2	73.0	"
− 9.6	33.9	51.3*	$MgCl_2$ $8H_2O$ β + $MgCl_2$ $6H_2O$	116.7	46.2	85.5	$MgCl_2.6H_2O$ + $MgCl_2.4H_2O$
− 3.4	34.4	52.3	$MgCl_2$ $8H_2O$ a + $MgCl_2$ $6H_2O$	152.6	49.1	96.4	$MgCl_2$ $4H_2O$
				about 181.5	55.8	126.0	$MgCl_2$ $4H_2O$ + $MgCl_2.2H_2O$
				186	56.1	128.0	$MgCl_2.2H_2O$

* = Unstable.

SOLUBILITY OF MAGNESIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 0°.

(Engel — Compt. rend. 104, 433, '87.)

Milligram Mols. per 10 cc. Solution. HCl.	Milligram Mols. per 10 cc. Solution. ½$MgCl_2$.	Sp. Gr. of Solutions.	Grams per Liter of Solution. HCl.	Grams per Liter of Solution. $MgCl_2$.
0.0	99.55	1.362	0.0	474.2
4.095	95.5	1.354	14 93	454.8
9.5	90.0	1.344	34.63	428.6
17.0	82.5	1.300	61.97	393.0
20.5	79.0	1.297	74.74	376.2
28.5	71.0	1.281	103.9	338.3
42.0	60.125	...	153.1	286.4
58.75	46.25	...	214.2	220.3
76.0	32.0	...	277.1	152.0
			sat. HCl (Ditte)	6.5

100 gms. H_2O dissolve 52.65 gms. $MgCl_2$ at 3.5°, 55.26 gms. at 25° and 58.66 gms. at 50°. (Biltz and Marcus, 1911.)

Solubility of Basic Magnesium Chloride in Water at 25°.

(Robinson and Waggaman, 1909.)

An excess of MgO was shaken with each of 20 $MgCl_2$ solutions at 25° for six months and the supernatant clear solutions and solid phases with adhering liquid, analyzed. The solutions were titrated with 0.02 *n* HCl for dissolved MgO (present as $Mg(OH)_2$). The composition of the solid phase in each case was ascertained by plotting the analytical results on a triangular diagram.

d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol. $MgCl_2$.	MgO.	Solid Phase.	d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol. $MgCl_2$.	MgO.	Solid Phase.
1.019	2.36	0.00008	Indefinite	1.141	17.53	0.0024	$2MgO.HCl.5H_2O$
1.038	4.47	0.00028	Solid Solution	1.162	18.52	0.0025	"
1.056	6.79	0.00048	"	1.192	22.04	0.00245	"
1.075	9.02	0.00080	"	1.245	26.88	0.0025	"
1.111	13.14	0.00115	"	1.274	29.80	0.0024	"
				1.321	34.22	0.0030	"

Solubility of Mixtures of Magnesium Chloride, Potassium Chloride and of Magnesium Potassium Chloride (Carnallite) in Water at Various Temperatures.

(van't Hoff and Meyerhoffer, 1899, 1912.)

t°.	Gms. per 100 Gms. H_2O. $MgCl_2$.	KCl.	Solid Phase.	Kind of Point on Curve.
−11.1	...	24.6	Ice + KCl	Cryohydric of KCl
−33.6	26	...	" + $MgCl_2.12H_2O$	" $MgCl_2.12H_2O$
−34.3	22.7	1.24	" + KCl + $MgCl_2.12H_2O$	" " + KCl
−21	34.9	2.03	Carnallite + $MgCl_2.12H_2O$ + KCl	Formation Temp. of Carnallite
−0	35.5	3.02	" + KCl	Point on Curve
25	38.4	4.76	" + "	" "
50	42	6.17	" + "	" " (Uhlig, 1913.)
61.5	42.6	7.20	" + "	" "
154.5	65.5	14.07	" + "	" "
167.5	88.1	17.26	" + "	M. pt. of Carnallite
25	55.5	0.83	" + $MgCl_2.6H_2O$	Point on Curve
50	59.13	0.50	" + "	" " (Uhlig, 1913.)
80	65	1.24	" + "	" "
115.7	85.6	1.66	" + " + $MgCl_2.4H_2O$	Transition Point
152.5	105.7	9.93	" + $MgCl_2.4H_2O$ + KCl	Upper Formation Temp. of [Carnallite
176	126.9	16.97	$MgCl_2.4H_2O$ + $MgCl_2.2H_2O$ + KCl	Transition Point
186	126.9	26.1	$MgCl_2.2H_2O$ + KCl	Point on Curve

Carnallite = $MgKCl_3.6H_2O$.

Solubility of Mixtures of Magnesium Chloride and Other Salts in Water at 25°.

(Lowenherz, 1894.)

Mixture.	Gms. Mols per 1000 Mols. H_2O.	Gms per Liter of Solution.
$MgCl_2.6H_2O + MgSO_4.6H_2O$	104 $MgCl_2$ + 14 $MgSO_4$	25. Cl + 4.4 SO_4
$MgCl_2.7H_2O + MgSO_4.6H_2O$	73 " + 15 "	19.5 Cl + 5.3 SO_4
$MgCl_2.6H_2O + MgCl_2.KCl.6H_2O$	106 Cl_2 + 1 K_2 + 105 Mg	26.9 Cl + 0.3 K + 45.7 SO_4

Results for all possible combinations of magnesium sulfate and potassium chloride and of magnesium chloride and potassium sulfate are also given.

100 cc. anhydrous hydrazine dissolve 2 gms. $MgCl_2$ at room temp. A flocculant ppt. separates on standing. (Welsh and Broderson, 1915.)

Freezing-point data (solubility, see footnote, p. 1) for mixtures of $MgCl_2$ and KCl, NaCl, AgCl, $ZnCl_2$ and $SnCl_2$ are given by Menge (1911). Data for mixtures of $MgCl_2$ + $SrCl_2$ and $MgCl_2$ + $MnCl_2$ are given by Sandonnini (1912, 1914). Data for $MgCl_2$ + $MgSO_4$ are given by Jaenecke (1912). Data for $MgCl_2$+TlCl are given by Korreng (1914) and data for $MgCl_2$+KCl and $MgCl_2$+HCl are given by Dernby (1918).

MAGNESIUM CINNAMATE $(C_6H_5.CH.CH.COO)_2Mg.H_2O$.

100 gms. sat. solution in water contain 0.85 gm. $(C_6H_5CH.CHCOO)_2Mg$ at 15° and 1.94 gms. at 100°. (Tarugi and Checchi, 1901.)

MAGNESIUM CHROMATE $MgCrO_4.7H_2O$.

100 grams H_2O dissolve 72.3 grams $MgCrO_4$ at 18°, or 100 grams solution contain 42.0 grams. Sp. Gr. = 1.422. (Mylius and Funk, 1897.)

MAGNESIUM POTASSIUM CHROMATE $MgCrO_4.K_2CrO_4.2H_2O$.

100 grams H_2O dissolve 28.2 grams at 20°, and 34.3 grams at 60°. (Schweitzer.)

MAGNESIUM PLATINIC CYANIDE $MgPt(CN)_4$.

SOLUBILITY IN WATER.

(Buxhoevden and Tamman — Z. anorg. Ch. 15, 319 '97.)

t°.	Gms. $MgPt(CN)_4$ per 100 Gms. Solution.	Solid Phase.	t°.	Gms. $MgPt(CN)_4$ per 100 Gms. Solution.	Solid Phase.
−4.12	24.90	$MgPt(CN)_4$ 6 8–8.1H_2O	48.7	40.89	$MgPt(CN)_4.4H_2O$
0.5	26.9	" (Red)	55	41.33	"
5.5	28.65	"	58.1	42.15	"
18.0	32.46	"	69.0	43.40	"
36.6	39.53	"	77.8	44.90	"
45.0	41.33	"	87.4	45.52	"
46.2	42.0	"	90.0	45.65	"
42.2	40.21	$MgPt(CN)_4$ $4H_2O$	93.0	45.04	"
46.3	39.85	" (Bright Green)	96.4	44.33	$MgPt(CN)_4.2H_2O$
			100.0	44.0	" (White)

MAGNESIUM Ferro**CYANIDES.**

SOLUBILITY IN WATER AT 17°.

(Robinson, 1909.)

One liter sat. sol. contains 1.95 gms. magnesium potassium ferrocyanide, $MgK_2FeC_6N_6$.

One liter sat. sol. contains 2.48 gms. magnesium ammonium ferrocyanide, $Mg(NH_4)_2FeC_6N_6$.

MAGNESIUM FLUORIDE MgF_2.

One liter of water dissolves 0.076 gm. MgF_2 at 18° by conductivity method. (Kohlrausch, 1905.)

One liter water dissolves 0.087–0.090 gm. MgF_2 at 0.3° and 0.084 gm. at 27° by conductivity method. (Kohlrausch, 1908.)

MAGNESIUM HYDROXIDE $Mg(OH)_2$.

One liter of water dissolves 0.008 – 0.009 gm. $Mg(OH)_2$ at 18° by conductivity method. (Dupre and Brutus, 1903.)

One liter of water dissolves 0.009 gm. $Mg(OH)_2$ at 18° by conductivity method (Kohlrausch and Rose, 1893), 0.012 gm. (Tamm, 1910).

SOLUBILITY OF MAGNESIUM OXIDE IN AQUEOUS SOLUTIONS CONTAINING SODIUM CHLORIDE AND SODIUM HYDROXIDE.

(Maigret, 1905.)

Gms. NaCl per Liter.	Gms. MgO per Liter Solution with Added: 0 8 g. NaOH per Liter.	4 0 g NaOH per Liter.
125	0.07	0.03
140	0.045	...
160	none	none

SOLUBILITY OF MAGNESIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AND OF AMMONIUM NITRATE AT 29°.

(Herz and Muhs — Z. anorg. Ch. 38, 140, '04.)

NOTE. — Pure $Mg(OH)_2$ was prepared and an excess shaken with solutions of ammonium chloride and of ammonium nitrate of different concentrations.

Concentration of NH_4Cl or of NH_4NO_3. (Normal.)		Acid Required for Liberated NH_4OH in 25 cc. (Normal)	Normality of: $Mg(OH)_2$.	Normality of: NH_4Cl.	Grams per Liter. $Mg(OH)_2$.	Grams per Liter. NH_4Cl.
·7	(NH_4Cl)	0.09835	0.156	0.388	4.55	20.86
0.466	"	0.1108	0.108	0.250	3.15	13.39
0.35	"	0.09835	0.089	0.172	2.60	9.21
0.233	"	0.1108	0.0638	0.106	1.86	5.67
0.175	"	0.1108	0.049	0.0771	1.43	4.13
0.35	(NH_4NO_3)	0.1108	0.0833	0.1834 (NH_4NO_3)	2.43	14.69 (NH_4NO_3)
0.175	"	0.1108	0.0495	0.076 "	1.45	6.09 "

MAGNESIUM IODATE $Mg(IO_3)_2$.

SOLUBILITY IN WATER.

(Mylius and Funk — Ber. 30, 1722, '97; Wiss. Abh. p. t. Reichanstalt 3, 446, '00.)

t°.	Gms. $Mg(IO_3)_2$ per 100 Gms. Solution.	Mols. $Mg(IO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Mg(IO_3)_2$ per 100 Gms. Solution.	Mols. $Mg(IO_3)_2$ per 100 Mols. H_2O.	Solid Phase.
0	3.1	0.15	$Mg(IO_3)_2.10H_2O$	0	6.8	0.34	$Mg(IO_3)_2.4H_2O$
20	10.2	0.55	"	10	6.4	0.30	"
30	17.4	1.01	"	18	7.6	0.40	"
35	21.9	1.35	"	20	7.7	0.40	"
50	67.5	10.0	"	35	8.9	0.47	"
				63	12.6	0.69	"
				100	19.3	1.13	"

Sp. Gr. of solution sat. at 18° = 1.078.

MAGNESIUM IODIDE $MgI_2.8H_2O$.

SOLUBILITY IN WATER. (Menschutkin, 1905, 1907.)

The salt was prepared by the action of water upon magnesium iodide dietherate (see p. 391) by which the octrahydrate and not the hexahydrate is formed. The crystals of this hydrate melt at 43.6°. The solubility determinations were made by the synthetic method.

t°.	Gms. per 100 Gms Sat. Solution. $MgI_2.6H_2O$ =	MgI_2	Solid Phase.
0	76	54.7	$MgI_2.8H_2O$
18	...	59.7 (d = 1.909)	" (Mylius and Funk, 1897.)
20	81	58.3	"
40	88	63.4	"
43.5 tr. pt.	90.8	65.4	" + $MgI_2.6H_2O$
43	89.8	64.7	$MgI_2.6H_2O$
80	90.3	65	"
120	90.9	65.4	"
160	91.7	66	"
200	93.4	67.2	"
215	94.3	67.9	"

MAGNESIUM IODIDE ETHERATES, ALCOHOLATES, ACIDATES, etc.

SOLUBILITIES RESPECTIVELY IN ETHER, ALCOHOL AND ACID SOLVENTS AT VARIOUS TEMPERATURES.

Boris N. Menschutkin. Monograph in the Russian Language entitled "On Etherates and Other Molecular Combinations of Magnesium Bromide and Iodide," St. Petersburg, 1907, pp 267 + XLVIII. Also published in "Memoirs of the St. Petersburg Polytechnic Institute," vols. 1–7, 1904–07 and in condensed form in vols. 49–67 of the Zeit. anorg. Chem., 1906–09.

Preparation of Material. The dietherate of magnesium iodide, $MgI_2.2C_4H_{10}O$, was prepared by the very gradual addition of iodine to a mixture of magnesium and dry ether. The reaction is not so violent as that which takes place during the preparation of the magnesium bromide dietherate (see p. 379). Two liquid layers are present at the end of the reaction and by slight cooling beautiful white needle-like crystals separate from the lower one. The growth of these crystals is also accompanied, as in the case of the magnesium bromide compound, by an evolution of ether droplets. Magnesium iodide dietherate is very hygroscopic, it is less stable than magnesium bromide dietherate, and becomes yellowish even after several hours, and brown after a day, owing probably to separation of iodine. As in the case of the magnesium bromide compound it reacts with very many organic compounds as alcohols, acids, ketones, etc., with liberation of ether and formation of addition products. These latter constitute the material used for the following solubility studies.

Method of Determination of Solubility. The synthetic (sealed tube) method of Alexejeff (Wied. Ann., 1885) was used almost exclusively.

Explanation of Results. As is seen from the following table, the solubility increases much more rapidly with temperature than in the case of magnesium bromide dietherate, especially in the vicinity of the melting point of $MgI_2.2C_4H_{10}O$ under its ethereal solution, which is at 23.6°. At this temperature there appears two layers, the lower one of which may be considered as a solution of ether in dietherate, and the upper one as a solution of the lower layer in ether. By increase of temperature a point is reached, at which both layers are miscible in all proportions (critical point). In the case of magnesium bromide dietherate no such critical point could be obtained. Both layers may be cooled below 23.6°, but only to about + 15° since here spontaneous crystallization of the dietherate almost always occurs, and the temperature rises to 23.6°. The great tendency to crystallize is probably due to the difference between the composition of the lower layer and of the saturated solution of the dietherate. The determinations in the vicinity of the critical point were quite difficult to make on account of the considerable opalescence which occurred and also the formation of a white substance, the nature of which was not ascertained. The critical concentration, as determined by means of the law of straight averages of Cailletet and Mathias, was approximately 40.3 per cent $MgI_2.2(C_2H_5)_2O$; the temperature, 38.5°. At concentrations of $MgI_2.2C_4H_{10}O$ greater than 54 per cent, a single liquid is again formed and the solubility curve can be followed up to the melting point of the dietherate at 51°.

SOLUBILITY OF MAGNESIUM IODIDE DIETHERATE IN ETHER AT DIFFERENT TEMPERATURES. (Menschutkin, 1906.)

t°.	Gms. per 100 Gms. Sat. Sol. $MgI_2.2(C_2H_5)_2O$	= MgI_2.	Mols. $MgI_2.2(C_2H_5)_2O$ per 100 Mols. Sat. Sol.	Solid Phase.
5.4	2.2	1.45	0.39	$MgI_2.2(C_2H_5)_2O$
11.8	3.7	2.43	0.66	"
15.6	5.3	3.46	0.96	"
18.1	8.3	5.4	1.55	"
20.4	11.6	7.55	2.24	"
22.2	17.3	11.28	3.56	"
23.6	22	14.4	4.67	"

Between these two concentrations of $MgI_2.2(C_2H_5)_2O$ two liquid layers separate (see below).

t°.	$MgI_2.2(C_2H_5)_2O$	MgI_2	Mols.	Solid Phase.
23.6	54.4	35.5	17.1	"
25	73	47.6	31.9	"
30	82.5	54	42.9	"
35	87	57	53.4	"
40	89.6	58.6	60.4	"
45	93.5	61.2	71.4	"
51.5 m. pt.	100	65.2	100	"

At 23.6° the saturated solution separates into two liquid layers which have the following composition at different temperatures.

t°.	Gms. per 100 Gms. Solution. Lower Layer. $MgI_2.2(C_2H_5)_2O$	= MgI_2.	Upper Layer. $MgI_2.2(C_2H_5)_2O$	= MgI_2.	
15	54.4	35.5	20.5	13.4	unstable
20	54.4	35.5	21.5	14.1	"
25	54.4	35.5	22.5	14.7	stable
30	54.4	35.5	23.5	15.4	"
35	54.1	35.3	26	17	"
36	53.5	34.9	27	17.7	"
37	52.2	34.2	28.5	18.7	"
38	50.5	33.1	32	21	"
38.5 crit. temp.	40.3	26.3	40.3	26.3	

MAGNESIUM IODIDE ALCOHOLATES and ANILINATE.

SOLUBILITY OF EACH IN THE RESPECTIVE ALCOHOLS OR ANILINE. (Menschutkin.)

$MgI_2.6CH_3OH$ in Methyl Alcohol. t°.	Gms. $MgI_2.6CH_3OH$ per 100 Gms. Sat. Sol.	$MgI_2.6C_2H_5OH$ in Ethyl Alcohol. t°.	Gms. $MgI_2.6C_2H_5OH$ per 100 Gms. Sat. Sol.	$MgI_2.6C_6H_5NH_2$ in Aniline. t°.	Gms. $MgI_2.6C_6H_5NH_2$ per 100 Gms. Sat. Sol.	$MgI_2.6(CH_3)_2CHOH$ in Dimethyl Carbinol. t°.	Gms. $MgI_2.6(CH_3)_2CHOH$ per 100 Gms. Sat. Sol.
0	49.6	0	21.9	0	3.3	10	57.1
20	52.6	20	33.2	60	3.9	30	60
40	55.3	40	44.4	100	5	50	63.3
60	58.8	60	55.3	130	8.5	70	67
80	60.6	80	65.5	150	17.5	90	71.2
100	63.3	100	74.7	170	38	110	76.2
120	66.2	120	82.7	180	52	120	79.4
140	69.5	130	87.2	188‡	64.5	130	84.8
160	73.2	140	93.3	200	65.9*	136	91.7
180	77.1	143	96	210	67.2*	138†	100
200	81.5	146.5†	100	230	69.8*		

* Solid Phase, $MgI_2.4C_6H_5NH_2$. † M. pt. ‡ Tr. pt.

MAGNESIUM IODIDE COMPOUNDS.

SOLUBILITY OF MAGNESIUM IODIDE COMPOUNDS WITH BENZALDEHYDE, ACETONE, ACETAL, AND ACETIC ACID IN EACH OF THESE LIQUIDS.
(Menschutkin)

$MgI_2.6C_6H_5COH$ in Benzaldehyde.		$MgI_2.6CH_3COCH_3$ in Acetone.		$MgI_2.2CH_3CH(OC_2H_5)_2$ in Acetal.		$MgI_2.6CH_3COOH$ in Acetic Acid.	
t°.	Gms. MgI_2-$6C_6H_5COH$ per 100 Gms. Sat. Sol.	t°.	Gms. MgI_2-$6CH_3COCH_3$ per 100 Gms. Sat. Sol.	t°.	Gms. MgI_2-$2CH_3CH(OC_2H_5)_2$ per 100 Gms. Sat. Sol.	t°.	Gms. MgI_2-$6CH_3COOH$ per 100 Gms. Sat. Sol.
0	3.2	0	4.9	20	0.15	20	0.6
20	3.8	30	6.7	60	0.45	40	2
40	5.3	50	8.3	77	0.60	60	5
60	7.7	60	10.2	(Between these two concentrations the mixture separates into two liquid layers)		70	9.5
80	11	70	15.2			80	18.5
100	18.5	80	28.6			95	42
110	26.5	85	40			105	54.5
120	40	90	59.2	77	92	115	65
125	53	95	80	79	93.7	125	73.8
130	74.5	100	92.5	81	95.5	135	85
136	94.2	105	98.5	83	97.3	140	94
139 m.pt.	100	106.5 m.pt.	100	86 m.pt.	100	142 m.pt.	100

On account of the properties of these molecular compounds, their great hygroscopicity, etc., the solubility determinations are not strictly accurate in all cases.

SOLUBILITY OF MAGNESIUM IODIDE COMPOUNDS WITH FORMIC AND ACETIC ACID ESTERS IN THE RESPECTIVE ESTERS.
(Menschutkin)

$MgI_2.6HCOOC_2H_5$ in Ethyl Formate.		$MgI_2.6CH_3COOCH_3$ in Methyl Acetate.		$MgI_2.6CH_3COOC_2H_5$ in Ethyl Acetate.		$MgI_2.6CH_3COOC_3H_7$ in Propyl Acetate.	
t°.	Gms. MgI_2-$6HCOOC_2H_5$ per 100 Gms. Sat. Sol.	t°.	Gms. MgI_2-$6CH_3COOCH_3$ per 100 Gms. Sat. Sol.	t°.	Gms. MgI_2-$6CH_3COOC_2H_5$ per 100 Gms. Sat. Sol.	t°.	Gms. MgI_2-$6CH_3COOC_3H_7$ per 100 Gms. Sat. Sol.
0	15.1	0	0.4	0	3.2	0	4.1
10	17.4	60	0.75	20	4.8	20	5.4
20	20.5	90	0.9	40	8.6	30	6.5
30	25	100	1.8	50	13.7	35	7.8
40	31.8	103	2.4	55	21.5	40	19
50	44	(Two layers here)		60	38	45	46
60	68	103	74.2	65	63.5	50	72.5
70.5 m.pt.	100	110	81.7	70	90.5	55	88.2
		120	98	75	92.7	60	96
		121 m.pt.	100	78.5 m.pt.	100	65 m.pt.	100

$MgI_2.6CH_3COO(iso)C_4H_9$ in Isobutyl Acetate.		$MgI_2.6CH_3COO(iso)C_5H_{11}$ in Isoamyl Acetate.	
t°.	Gms. $MgI_2.6CH_3COO(iso)C_4H_9$ per 100 Gms. Sat. Sol.	t°.	Gms. $MgI_2.6CH_3COO(iso)C_5H_{11}$ per 100 Gms. Sat. Sol.
0	10.5	0	7.7
20	13.6	20	11.5
40	17.6	40	20.9
60	24.9	45	25.5
70	33.7	50	33.2
80	52	55	47.8
85	89	57.5	63
87.5 m.pt.	100	60 m.pt.	100

SOLUBILITY OF MAGNESIUM IODIDE COMPOUNDS WITH ACETONITRILE, ACETAMIDE AND URETHAN IN THESE LIQUIDS. (Menschutkin.)

$MgI_2.6CH_3CN$ in Acetonitrile.		$MgI_2.6CH_3CONH_2$ in Acetamide.			$MgI_2.6NH_3COOC_2H_5$ in Urethan.		
t°.	Gms. MgI_2.-$6CH_3CN$ per 100 Gms. Sat. Sol.	t°.	Gms. MgI_2.-$6CH_3CONH_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. MgI_2.-$6NH_3COOC_2H_5$ per 100 Gms. Sat. Sol.	Solid Phase.
0	37.2	82 m. pt. of acetamide			49 m. pt. of urethan		
30	49.8	70	28	CH_3CONH_2	45	27.5	$NH_3COOC_2H_5$
50	58.2	58	46.7	"	39	45	"
70	67.9	49*	56.5	"+MgI_2 $6CH_3CONH_2$	32*	51.8	"+MgI_2 $NH_3COOC_2H_5$
75	71.7	80	63.4	MgI_2 $6CH_3CONH_2$	40	55	$MgI_2.NH_3COOC_2H_5$
80	76.5	130	76	"	60	64.7	"
85	83	160	85.5	"	80	78.8	"
89	91.3	170	90.8	"	86	92.5	"
		177†	100	"	87†	100	"

* Eutec † m pt.

MAGNESIUM IODOMERCURATE $MgI_2.2HgI_2.7H_2O$.

The sat. solution in water at 17.8° has the composition $MgI_2.1.29HgI_2.11.06H_2O$ and Sp. Gr. 2.92. (Duboin, 1906.)

MAGNESIUM DiLACTATE $Mg(C_6H_8O_5).6H_2O$ racemic, $Mg(C_6H_8O_5).3H_2O$, inactive.

SOLUBILITY OF RACEMIC AND OF INACTIVE MAGNESIUM DILACTATE IN WATER. (Jungfleisch, 1912)

100 gms. H_2O dissolve 7 to 8 gms. racemic and 2.28 gms. inactive lactate at 15°.

MAGNESIUM LAURATE, MYRISTATE, PALMITATE and STEARATE.

SOLUBILITY OF EACH IN SEVERAL SOLVENTS. (Jacobson and Holmes, 1916)

Solvent.	t°.	Gms Each Salt Determined Separately per 100 Gms. Solvent.			
		Mg Laurate $(C_{11}H_{23}COO)_2$-Mg.	Mg Myristate $(C_{13}H_{27}COO)_2$-Mg.	Mg Palmitate $(CH_3(CH_2)_{14}$-$COO)_2Mg$.	Mg Stearate $(CH_3(CH_2)_{16}$-$COO)_2Mg$.
Water	15	0.010	0.006	0.005	0.003
"	25	0.007	0.006	0.008	0.004
"	35	0.010	0.007	0.006	0.007
"	50	0.026	0.014	0.009	0.008
Abs. Ethyl Alcohol	15	0.519	0.158	0.034	0.017
"	25	0.591	0.236	0.058	0.023
"	35	0.805	0.373	0.085	0.031
"	50	1.267	0.577	0.151	...
Methyl Alcohol	15	1.095	0.571	0.227	0.084
"	25	1.108	0.763	0.36	0.100
"	51.5	...	...	0.50	0.166
Ether	25	0.015	0.010	0.004	0.003
Ethyl Acetate	15	0.004	0.004	0.004	0.004
"	35	0.011	0.010	0.007	0.008
"	50	0.024	0.021	0.013	...
Amyl alcohol	15	0.191	0.086	0.043	0.014
"	25	0.236	0.145	0.066	0.018
"	35	1.481	0.438	0.104	0.039
"	50	4.869	1.893	0.263	0.105
Amyl Acetate	15	0.119	0.063	0.039	0.029
"	25	0.162	0.073	0.045	0.030
"	34.6	0.259	0.105	0.057	0.046
"	50	1.939	0.605	0.216	0.115

MAGNESIUM NITRATE $Mg(NO_3)_2$.

SOLUBILITY IN WATER.
(Funk — Wiss. Abh. p. t. Reichanstalt 3, 437, '00.)

t°.	Gms. $Mg(NO_3)_2$ per 100 Gms. Solution.	Mols. $Mg(NO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Mg(NO_3)_2$ per 100 Gms. Solution.	Mols. $Mg(NO_3)_2$ per 100 Mols. H_2O.	Solid Phase.
−23	35.44	6.6	$Mg(NO_3)_2.9H_2O$	40	45.87	10.3	$Mg(NO_3)_2.6H_2O$
−20	36.19	7.0	"	80	53.69	14.6	"
−18	38.03	7.4	"	90	57.81	16.7	"
−18	38.03	7.37	$Mg(NO_3)_2.6H_2O$	89	63.14	20.9	*
− 4.5	39.50	7.92	"	77.5	65.67	23.2	*
0	39.96	8.08	"	67	67.55	25.1	*
+18	42.33	8.9	"				

* Reverse curve.

Sp. Gr. of solution saturated at 18° = 1.384.

The eutectic is at −29° and 34.6 gms. $Mg(NO_3)_2$ per 100 gms. sat. solution. Fusion-point data for $Mg(NO_3)_2 + Zn(NO_3)_2$ are given by Vasilev (1909.) Results for $Mg(NO_3)_2 + HNO_3$ are given by Dernby (1918).

MAGNESIUM OLEATE $(CH_3(CH_2)_{13}CH:CH.CH_2COO)_2Mg$.

One liter H_2O dissolves about 0.23 gm. oleate (soap). (Fahrion, 1916)
100 gms. glycerol (*d* 1.114) dissolve 0.94 gm. oleate. (Asselin, 1873.)

MAGNESIUM OXALATE $MgC_2O_4.2H_2O$.

One liter of water dissolves 0.3 gm. MgC_2O_4 at 18° (conductivity method). (Kohlrausch, 1905)

MAGNESIUM OXIDE MgO.

Fusion-point data (quenching method) for $MgO + SiO_2$ are given by Bowen and Anderson, 1914.

MAGNESIUM PHOSPHATE $MgHPO_4.3H_2O$.

SOLUBILITY OF MAGNESIUM PHOSPHATE IN AQUEOUS SOLUTIONS OF PHOSPHORIC ACID AT 25°. (Cameron and Bell, 1907)

The mixtures were constantly agitated for two months and the clear solutions analyzed for magnesia and phosphoric acid.

d_{25} of Sat. Sol.	Gms per Liter. MgO.	Gms per Liter. P_2O_5	Solid Phase.	d_{25} of Sat. Sol.	Gms per Liter. MgO	Gms per Liter. P_2O_5.	Solid Phase.
...	0.207	0.486	$MgHPO_4.3H_2O$	...	109.5	439	$MgHPO_4.3H_2O$
...	0.280	0.732	"	1.470	122.6	498	"
...	0.553	1.917	"	...	129.9	546.5	"
...	1.438	4.85	"	...	140	584	"
1.006	2.23	7.35	"	1.595	146.8	623.3	"
1.017	4.73	16.84	"	...	147.3	625.9	"
1.042	11.19	38.59	"	...	150.3	645.8	"
1.069	17.33	61.21	"	...	155.5	680.7	"
1.109	26.09	93.09	"	...	160	700	" $+MgH_4(PO_4)_2.XH_2O$
1.144	37.40	130.7	"	1.626	87.1	779.6	$MgH_4(PO_4)_2.XH_2O$
1.285	75.5	281.8	"	1.644	77.1	809.6	"
			"	1.654	70.6	835.1	"

MAGNESIUM (Hypo) PHOSPHATE $Mg_2P_2O_6.12H_2O$.

One liter of water dissolves 0.066 gm. hypophosphate. (Salzer, 1886.)
One liter of water dissolves 5 gms. magnesium hydrogen hypophosphate, $MgH_2P_2O_6.4H_2O$. (Salzer.)

MAGNESIUM SALICYLATE $Mg(C_7H_5O_3)_2.4H_2O$.

100 gms. sat. solution in water contain 20.4 gms. salicylate at 15° (14.3 gms. Squire and Caines, 1905), and 79.7 gms. at 100°. (Tarugi and Checchi, 1901.)
100 gms. 90% alcohol dissolve 0.6 gm. salicylate at 15°–20°. (Squire and Caines, 1905.)

MAGNESIUM SILICATE $MgSiO_3$.

Fusion-point data for mixtures of $MgSiO_3 + MnSiO_3$ are given by Lebedew (1911). Results for $MgSiO_3 + Na_2SiO_3$ are given by Wallace (1909).

MAGNESIUM FLUOSILICATE $MgSiF_6.6H_2O$.

One liter of water dissolves 652 gms. of the salt at 17.5°. Sp. Gr. of solution = 1.235. (Stolba, 1877.)

MAGNESIUM SUCCINATE $C_4H_4O_4Mg.5H_2O$.

100 gms. sat. solution in water contain 24.35 gms. succinate at 15° and 66.36 gms. at 100°. (Tarugi and Checchi, 1901.)

MAGNESIUM SULFATE $MgSO_4.7H_2O$.

SOLUBILITY IN WATER.

(Results by several investigators. 4th Ed. Landolt and Börnstein, "Tabellen," 1912.)

t°.	Gms. $MgSO_4$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $MgSO_4$ per 100 Gms. Sat. Sol.	Solid Phase.
				Unstable Portions of Curve.	
−2.9	13.9 (1)	Ice	−8.4	23.6 (1)	Ice
−3.9	19. (2)	" $+MgSO_4.12H_2O$	−5	19 (12)	" $+MgSO_4.7H_2O$ rhomb.
+1.8	21.1 (2)	$MgSO_4.12H_2O+MgSO_4.7H_2O$	0	20.6 (3)	$MgSO_4.7H_2O$ rhomb.
10	23.6 (3)	$MgSO_4.7H_2O$ (rhombic)	0	25.8 (3)	" β hexagonal
20	26.2 (3)	"	+10	27.9 (3)	" "
25	26.8 (4)	"	20	30 (3)	" "
30	29 (5)	"	0	29 (3)	$MgSO_4.6H_2O$
40	31.3 (5)	"	10	29.7 (3)	"
48	33 (6)	" $+MgSO_4.6H_2O$	20	30.8 (3)	"
50	33.5 (7)	$MgSO_4.6H_2O$	30	31.2 (7)	"
55	34.3 (7)	"	70	37.3 (5)	"
60	35.5 (5)	"	80	39.1 (5)	"
68	37 (8)	" $+MgSO_4.H_2O$	90	40.8 (5)	"
80	38.6 (7)	$MgSO_4.H_2O$	100	42.5 (5)	"
83	40.2 (9)	"			
99.4	40.6 (10)	"			
164	29.3 (11)	"			
188	20.3 (11)	"			

(1) de Coppet, 1872; (2) Cottrell et al, 1901; (3) Loewel, 1855; (4) Basch, 1901; (5) Mulder; (6) Van der Heide, 1893; (7) Smith, 1912; (8) Van't Hoff, 1901; (9) Geiger, 1904; (10) Meyerhoffer, 1912; (11) Etard, 1894; (12) Guthrie, 1876. See also Tilden, 1884.

Data for densities of aq. $MgSO_4$ solutions are given by Barnes and Scott, 1898.

SOLUBILITY OF MAGNESIUM SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE AT 25° AND VICE VERSA.

(Van Klooster, 1917.)

Gms. per 100 Gms. Sat. Sol. $MgSO_4$.	K_2SO_4.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. $MgSO_4$.	K_2SO_4.	Solid Phase.
26.76	0	$MgSO_4.7H_2O$	13.26	10.34	$MgK_2(SO_4)_2.6H_2O$
26.67	1.68	"	12.88	10.51	"
26.57	2.34	"	12.68	10.70	" $+K_2SO_4$
26.36	3.76	"	12.06	10.77	K_2SO_4
26.39	4.02	" $+MgK_2(SO_4)_2.6H_2O$	10.69	10.84	"
18.76	7.02	$MgK_2(SO_4)_2.6H_2O$	7.8	11.10	"
16.36	8.43	"	4	11.03	"
14.27	9.63	"	0	10.77	"

100 gms. 95% formic acid dissolve 0.34 gm. $MgSO_4$ at 19°. (Aschan, 1913.)

SOLUBILITY OF MAGNESIUM SULFATE IN METHYL AND ETHYL ALCOHOLS
(de Bruyn, 1892.)

Solvent.	t°.	Per 100 Gms. Solvent.	Solvent.	t°.	Per 100 Gms. Solvent.
Abs. CH_3OH	18	1.18 gms. $MgSO_4$	93% Methyl Alc.	17	9.7 gms. $MgSO_4.7H_2O$
"	17	41 " $MgSO_4.7H_2O$	50% " "	3-4	4.1 " "
"	3-4	29 " "	Abs. C_2H_5OH	3	1.3 " "

SOLUBILITY IN AQUEOUS ETHYL ALCOHOL.
(Schiff, 1861.)

Weight per cent Alcohol	10	20	40
Gms. $MgSO_4.7H_2O$ per 100 gms. solvent	64.7	27.1	1.65

SOLUBILITY OF MAGNESIUM SULFATE IN SATURATED SUGAR SOLUTION AT 31.25°.
(Kohler, 1897.)

100 gms. saturated aqueous solution contain 46.52 gms sugar + 14 gms. $MgSO_4$.

100 gms. water dissolve 119.6 gms. sugar + 36 gms. $MgSO_4$.

Data for the system magnesium sulfate, phenol, and water are given by Timmermans, 1907.

Fusion-point data for mixtures of $MgSO_4 + K_2SO_4$ are given by Ginsberg, 1906; Nacken, 1907a and Grahmann, 1913. Results for $MgSO_4 + Na_2SO_4$ are given by Nacken 1907b.

MAGNESIUM POTASSIUM SULFATE $MgK_2(SO_4)_2.6H_2O$.

SOLUBILITY IN WATER.
(Tobler, 1855.)

t° =	0°	20°	30°	45°	60°	75°
Gms. $MgK_2(SO_4)_2$ per 100 gms. H_2O	14.1	25	30.4	40.5	50.2	59.8

100 gms. H_2O dissolve 30.52 gms. $MgK_2(SO_4)_2.6H_2O$ at 15°. (Lothian, 1909.)

MAGNESIUM SULFITE $MgSO_3.6H_2O$.

10 gms. cold water dissolve 1.25 gms. sulfite; 100 gms. boiling water dissolve 0.83 gm. (Hager, 1875.)

100 gms. H_2O dissolve 1 gm. sulfite at 15°. (Squire and Caines, 1905.)

MAGNESIUM SULFONATES.

SOLUBILITY IN WATER AT 20°.
(Sandquist, 1912.)

Compound.	Gms. Anhydrous Salt per 100 Gms. H_2O.
Magnesium -2-Phenanthrene Monosulfonate $6H_2O$	0.051
" -3- " " $4H_2O$	0.116
" -10- " " $5H_2O$	0.22

β MALAMINIC ACID $CH_2(OH)COOH:CH_2CONH_2$, $CH_2COO.NH_3.CHCOOH$.

SOLUBILITY IN WATER AT 18°. (Lutz, 1902.)

Compound.	M.-pt.	Gms. per 100 Gms. H_2O.	$(\alpha)_D$ in Water $C=1$, $l=2$.
d β Malaminic Acid	149	7.52	+9.70
l "	149	7.50	−9.33
r "	148	4.02	...

MALEIC ACID COOHCH:CH.COOH (see also p. 304).

SOLUBILITY IN SEVERAL ALCOHOLS. (Timofeiew, 1894.)

Alcohol.	t°.	Gms. $(CHCOOH)_2$ per 100 Gms. Sat. Sol.	Alcohol.	t°.	Gms. $(CHCOOH)_2$ per 100 Gms. Sat. Sol.
Methyl Alcohol	22.5	41	Propyl Alcohol	0	20
Ethyl Alcohol	0	30.2	"	22.5	24.3
"	22.5	34.4	Isobutyl Alcohol	0	14.2
			"	22.5	17.5

Data for the distribution of maleic acid between ether and water at 25° are given by Chandler, 1908.

Freezing-point data for mixtures of maleic acid and *l* mandelic acid are given by Centnerszwer, 1899.

MALIC ACID *l* $COOH.CH_2CHOHCOOH$.

100 gms. methyl alcohol dissolve	124.8	gms. malic acid at	0°.	(Timofeiew, 1894.)
" " " "	167.7	" " "	19.1°.	"
" ethyl " "	91.4	" " "	19°.	"
" propyl " "	54	" " "	19°.	"
" dichlorethylene "	0.009	" " "	15°.	(Wester & Bruins, 1894.)
" trichlorethylene "	0.010	" " "	15°.	" "

DISTRIBUTION OF MALIC ACID BETWEEN WATER AND ETHER. (Pinnow, 1915.)

Results at 15°.			Results at 25.5°.		
Gm. Mols Acid per Liter: H_2O Layer.	Ether Layer.	Dist. Coeff.	Gm Mols Acid per Liter: H_2O Layer.	Ether Layer.	Dist. Coeff.
0.564	0.0091	62	1.179	0.0172	68.4
0.288	0.0045	64	0.582	0.0082	71
0.151	0.0024	62.9	0.293	0.0040	73
0.967	0.0157	61.6	0.142	0.0020	71

Freezing-point data for *i* malic acid + *l* mandelic acid are given by Centnerszwer, 1899.

MALONIC ACID $CH_2(COOH)_2$.

SOLUBILITY IN WATER.

(Klobbie, 1897; Miczynski, 1886; Henry, 1884; Lamouroux, 1898, 1899.)

t°.	Gms. $CH_2(COOH)_2$ per 100: Gms. Solution.*	cc. Solution (L.).	t°.	Gms $CH_2(COOH)_2$ per 100: Gms. Solution.*	cc. Solution (L.).
0	52	61	50	71	93
10	56.5	67	60	74.5	100
20	60.5	73	70	...	106
25	62.2	76.3	80	82	...
30	64	80	100	89	...
40	68	86.5	132 m. pt.	100	...

* Average curve from results of K., M., and H.

100 gms. 95% formic acid dissolve 22.42 gms. malonic acid at 19.5°. (Aschan, 1913.)

SOLUBILITY OF MALONIC ACID IN ALCOHOLS.
(Timofeiew, 1894.)

Alcohol.	t°.	Gms. $CH_2(COOH)_2$ per 100 Gms. Sat. Sol.	Alcohol.	t°.	Gms. $CH_2(COOH)_2$ per 100 Gms. Sat. Sol.
Methyl Alcohol	−18.5	42.7	Ethyl Alcohol	+19.5	41.3
" "	−15	43.5	Propyl Alcohol	−18.5	19.5
" "	0	47.3	" "	−15	20.2
" "	+19	52.5	" "	0	24.3
" "	+19.5	53.3	" "	+19	29.5
Ethyl Alcohol	−18.5	30	" "	+19.5	30.7
" "	−15	30.7	Isobutyl Alcohol	0	17.5
" "	0	35.3	" "	19	21.2
" "	+19	40.1			

SOLUBILITY OF MALONIC ACID IN ETHER.
(Klobbie, 1897.)

t°.	Gms. $CH_2(COOH)$ per 100 Gms. Solution.	t°.	Gms. $CH_2(COOH)_2$ per 100 Gms. Solution.	t°.	Gms $CH_2(COOH)_2$ per 100 Gms. Solution.
0	6.25	30	10.5	100	46
10	7.74	80	33	110	56
20	9	90	39	120	70
25	9.7			132 m. pt.	100

100 gms. saturated solution of malonic acid in pyridine contain 14.6 gms. at 26°. (Holty, 1905.)

SOLUBILITY OF SUBSTITUTED MALONIC ACIDS IN WATER.
(Lamouroux, 1899)

t°.	Gms per 100 cc Saturated Aqueous Solution.					
	Malonic Acid.	Methyl Malonic Acid.	Ethyl Malonic Acid.	*n* Propyl Malonic Acid	*n* Butyl Malonic Acid.	Iso Amyl Malonic Acid.
0	61.1	44.3	52.8	45.6	11.6	38.5
15	70.2	58.5	63.6	60.1	30.4	51.8
25	76.3	67.9	71.2	70	43.8	79.3
30	92.6	91.5	90.8	94.4	79.3	83.4

DISTRIBUTION OF MALONIC ACID BETWEEN ETHER AND WATER AT 25°.
(Chandler, 1908)

Mols Acid per Liter		Coef. $\frac{\text{Conc } H_2O}{\text{Conc Ether}}$.	Dist. Coef. corrected for Ionization.
H_2O Layer.	Ether Layer.		
0.1478	0.0135	10 94	9.86
0.1121	0.0102	11.07	9.79
0.0862	0.0076	11.28	9.86
0.0331	0.0027	12.22	9.82

MANDELIC ACID $C_6H_5.CH(OH)COOH$ *i* and *d*.

SOLUBILITY IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. $C_6H_5CHOHCOOH$ per 100 Gms. Sat Sol.		Authority.
Water	20	15.95	(inactive acid)	(Schlossberg, 1900.)
"	20	19.17	(dextro acid)	"
Methyl Alcohol	0	51.1	(inactive acid)	(Timofeiew, 1894.)
" "	16.5	64.9	"	"
Ethyl Alcohol	0	46.7	"	"
" "	16.5	53.6	"	"
Propyl Alcohol	0	35	"	"
" "	16.5	43	"	"
95% Formic Acid	19	40	"	(Aschan, 1913.)

FREEZING-POINT DATA (Solubility, see footnote, p. 1) ARE GIVEN FOR THE FOLLOWING MIXTURES OF MANDELIC ACID AND OTHER COMPOUNDS.

d Mandelic Acid + *l* Mandelic Acid		(Adriani, 1900.)
i " " + *l* " "		(Centnerszwer, 1899.)
i " Methylester + *l* Mandelic Methylester		"
i " Isobutylester + *l* Mandelic Isobutylester		"
" Acid + Dimethylpyrone		(Kendall, 1914.)
l " *l* Menthylester + *d* Mandelic *l* Menthylester		(Findlay and Hickmans, 1907.

Menthyl **MANDELATES.**

SOLUBILITY IN ETHYL ALCOHOL.
(Findlay and Hickmans, 1909.)

Solvent.	t°.	Gms. per 100 Gms Solvent. *L.*	*D.*	Solid Phase.	Solvent.	t°.	Gms. per 100 Gms. Solvent. *L.*	*D.*	Solid Phase.
80% Alcohol	35	...	1.08	*D*	80% Alcohol	10	...	0.287	*D*
"*	35	3.19	...	*L*	"	10	0.595	...	*L*
"	35	0.80	0.80	*R*	"	10	0.184	0.184	*R*
"	35	0.544	1.35	*D+R*	"	10	0.404	0.291	*D+R*
"	35	2.83	0.60	*L+R*	"	10	0.505	0.088	*L+R*
"	25	...	0.595	*D*	Abs. Alcohol	0	...	1.06	*D*
"	25	1.64	...	*L*	"	0	1.93	...	*L*
"	25	0.448	0.448	*R*	"	0	0.625	0.625	*R*
"	25	0.321	0.882	*D+R*	"	0	0.535	0.915	*D+R*
"	25	1.192	0.267	*L+R*	"	0	1.03	0.54	*L+R*

* $d_{25} = 0.8517$.

$D = l$ menthyl d mandelate, $[\alpha]_D^{17.5} = -9.45°$ in alcohol.

$L = l$ menthyl l mandelate $[\alpha]_D^{20} = -140.92°$ in alcohol.

$R = l$ menthyl r-mandelate $[\alpha]_D^{11.3} = -75.03$ in alcohol.

MANGANESE BORATE $MnH_4(BO_3)_2$.

SOLUBILITY IN WATER AND IN AQUEOUS SALT SOLUTIONS.
(Hartley and Ramage — J. Ch. Soc. 63, 137, '93.)

t°.	Grams $MnH_4(BO_3)_2$ per Liter in Solutions of: H_2O + trace Na_2SO_4.	Na_2SO_4 (0.2 Gms. per Liter).	Na_2SO_4 (20 Gms. per Liter).	NaCl (20 Gms. per Liter).	$CaCl_2$ (20 Gms. per Liter).
14	0.94	1.7	...	...	...
18	...	...	0.77	1.31	2.91
40	0.50	0.69 (52°)	0.65	...	2.44
60	...	...	0.36	0.60	2.25
80	0.08	...	0.12	0.29	1.35

MANGANESE BROMIDE $MnBr_2$.

SOLUBILITY IN WATER.
(Etard, 1894.)

t°.	Gms. $MnBr_2$ per 100 Gms. Solution.	Solid Phase.	t°.	Gms. $MnBr_2$ per 100 Gms. Solution.	Solid Phase.
−20	52.3	$MnBr_2.4H_2O$	40	62.8	$MnBr_2.4H_2O$
−10	54.2	"	50	64.5	"
0	56.0	"	60	66.3	"
10	57.6	"	70	68.0	"
20	59.5	"	80	69.2	$MnBr.2H_2O$
25	60.2	"	90	69.3	"
30	61.1	"	100	69.5	"

MANGANESE CARBONATE $MnCO_3$.

One liter water dissolves $5.659.10^{-4}$ mols. $MnCO_3$ = 0.065 gm. at 25°. (Ageno and Valla, 1911.)

MANGANESE CHLORIDE $MnCl_2$.

SOLUBILITY IN WATER.

(Etard; Dawson and Williams — Z. physik. Chem. 31, 63, '99.)

t°.	Sp. Gr. of Solutions.	Grams $MnCl_2$ per 100 Grams Water.	Grams $MnCl_2$ per 100 Grams Solution.	Mols. $MnCl_2$ per 100 Mols. H_2O.	Solid Phase.
−20	...	53.8	35.0	...	$MnCl_2.4H_2O$
−10	...	58.7	37.0	...	"
0	...	63.4	38.8	...	"
+10	...	68.1	40.5	...	"
20	...	73.9	42.5	...	"
25	1.4991	77.18	43.55	11.08	"
30	1.5049	80.71	44.68	11.55	"
40	1.5348	88.59	46.96	12.69	"
50	1.5744	98.15	49.53	14.05	"
57.65	1.6097	105.4	51.33	15.10	"
60	1.6108	108.6	52.06	15.55	$MnCl_2.2H_2O$
70	1.6134	110.6	52.52	15.85	"
80	...	112.7	52.98	16.14	"
90	...	114.1	53.2	...	"
100	...	115.3	53.5	...	"
120	...	118.8	54.3	...	"
140	...	119.5	55.0	...	"

One liter of water dissolves 87.0 grams $MnCl_2$. One liter of sat. HCl dissolves 19.0 grams $MnCl_2$ at 12°. (Ditte — Compt. rend. 92, 242, '81.)

EQUILIBRIUM IN THE SYSTEM MANGANESE CHLORIDE, POTASSIUM CHLORIDE AND WATER. (Süss, 1913.)

t°.	Gms. per 100 Gms. Sat. Sol $MnCl_2$.	KCl.	Solid Phase.	t°	Gms. per 100 Gms. Sat. Sol. $MnCl_2$.	KCl.	Solid Phase.
6	40.23	...	$MnCl_2.4H_2O$	52.8	50.14	6.01	$MnCl_2.4H_2O+MnCl_2.2H_2O+$1.1.2
6	35.94	9.41	" +1.1.2+KCl	58.3	51.72	...	$MnCl_2.4H_2O+MnCl_2.2H_2O$
6	...	23.06	KCl	62.6	51.86	...	$MnCl_2.2H_2O$
28.4	44.46	...	$MnCl_2.4H_2O$	62.6	49.95	6.67	" +1.1.2
28.4	43.28	8.66	" +1.1.2	62.6	44.05	12.49	1.1.2+$MnCl_2.2KCl.2H_2O$
28.4	38.65	13.79	" +1.2.2+KCl	62.6	36.85	18.77	$MnCl_2.2KCl.2H_2O+MnCl_2.4KCl$
28.4	...	26.91	KCl	62.6		31.57	KCl

1.1.2 = $MnCl_2.KCl.2H_2O$. 1.2.2 = $MnCl_2.2KCl.2H_2O$

100 cc. anhydrous hydrazine dissolve 13 gms. $MnCl_2$ at room temp. (Welsh and Broderson, 1915).

Fusion-point data for $MnCl_2 + SnCl_2$ (Sandonnini, 1911), $MnCl_2 + SnCl_2$ (Sandonnini and Scarpa, 1911), $MnCl_2 + ZnCl_2$ (Sandonnini, 1912 and 1914).

MANGANESE CINNAMATE $(C_6H_5CH:CHCOO)_2Mn$.

100 gms. H_2O dissolve 0.26 gm. manganese cinnamate at 26°. (De Jong, 1909.)

MANGANESE FLUOSILICATE $MnSiF_6.6H_2O$.

100 gms. H_2O dissolve 140 gms. salt at 17.5°. Sp. Gr. of solution = 1.448. (Stolba, 1883.)

MANGANESE HYDROXIDE $Mn(OH)_2$.

One liter H_2O dissolves $2.15.10^{-5}$ gms. mols. $Mn(OH)_2$ at 18°. (Sackur and Fritzmann, 1909.)

One liter H_2O dissolves $2.10.10^{-4}$ gms. mols. $Mn(OH_2)$ at 18°. (Tamm, 1910.)

The determination of S. & F. was made by the neutralization method of Kuster, that is, by determining the conductivity minimum on adding $Ba(OH)_2$ to $MnSO_4$ solution and calculating the $Mn(OH)_2$ remaining in solution.

SOLUBILITY OF MANGANESE HYDROXIDE IN AQUEOUS SOLUTIONS OF ORGANIC SALTS.
(Tamm, 1910.)

(25 cc. of the neutral salt solution + 25 cc. of aqueous suspension of $Mn(OH)_2$ were shaken different lengths of time. Temp. not stated.)

100 cc. sat. solution in 1 *n* sodium tartrate solution contain 0.052 gm. Mn_3O_4.
100 cc. sat. solution in 1 *n* sodium malate solution contain 0.032 gm. Mn_3O_4.
100 cc. sat. solution in 1 *n* sodium citrate solution contain 0.095 gm. Mn_3O_4.

MANGANESE IODOMERCURATE $3MnI_2.5HgI_2.20H_2O$.

A saturated solution of the salt in water at 17° has the composition $1.4 MnI_2.HgI_2.10.22H_2O$ and density 2.98. (Duboin, 1906.)

MANGANESE NITRATE $Mn(NO_3)_2$.

SOLUBILITY IN WATER.
(Funk — Wiss. Abh. p. t. Reichanstalt 3, 438, '00.)

t°.	Gms. $Mn(NO_3)_2$ per 100 Gms. Sol.	Mols. $Mn(NO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Mn(NO_3)_2$ per 100 Gms. Sol.	Mols. $Mn(NO_3)_2$ per 100 Mols. H_2O.	Solid Phase.
−29	42.29	7.37	$Mn(NO_3)_2.6H_2O$.	18	57.33	13.5	$Mn(NO_3)_2.6H_2O$.
−26	43.15	7.63	"	25	62.37	16.7	"
−21	44.30	8.0	"	27	65.66	19.2	$Mn(NO_3)_2.3H_2O$.
−16	45.52	8.4	"	29	66.99	20.4	"
−5	48.88	9.61	"	30	67.38	20.7	"
0	50.49	10.2	"	34	71.31	24.9	"
+11	54.50	12.0	"	35.5	76.82	33.3	"

Sp. Gr. of solution saturated at 18° = 1.624.
The Eutec is at −36° and 40.5 gms. $Mn(NO_3)_2$ per 100 gms. Sat. Sol.

MANGANESE OXALATE $MnC_2O_4.2H_2O$.

SOLUBILITY IN AQUEOUS SOLUTIONS AT 25°.
(Hauser and Wirth, 1909.)

In Oxalic Acid Solutions. Per 1000 Gms. Sat Sol. G. Mols. $(COOH)_2$.	Gms. $Mn(COO)_2$.	In Ammonium Oxalate Solutions. Per 1000 Gms Sat Sol. G Mols $(NH_4)_2(COO)_2$	Gms $Mn(COO)_2$.	In Sulfuric Acid Solutions. Per 1000 Gms Sat Sol Normality H_2SO_4.	Gms $Mn(COO)_2$.	Solid Phase.
0	0.312	0.005	0.338	0.025	1.825	$MnC_2O_4.2H_2O$
0.0125	0.759	0.025	0.479	0.24	8.850	"
0.025	0.930	0.050	0.761	1	25.955	"
0.050	1.080	0.125	1.789	2.389	51.080	"
0.125	1.396	0.245	3.970	2.987	60.109	$MnC_2O_4.2H_2O+(COOH)_2$
0.25	1.708	0.245	4.005	3.952	73.200	"
0.49	2.081	0.281	4.650	4.500	82.401	"

Results are also given for the solubility of $MnC_2O_4.2H_2O$ in aq. solutions of H_2SO_4 containing also about 0.25 gm. mols. free oxalic acid per liter at 25°

MANGANESE OXIDE MnO.

Fusion-point data for mixtures of manganese oxide and silicic acid are given by Doernickel, 1907.

MANGANESE (Hypo) PHOSPHITE $Mn(PH_2O_2)_2H_2O$.

100 gms. H_2O dissolve 15.15 gms. salt at 25°, and 16.6 gms. at b. pt. (U. S. P.)

MANGANESE SILICATE $MnSiO_3$.

Fusion-point data for mixtures of manganese silicate and titanate are given by Smolensky, 1911–12.

MANGANESE SULFATE $MnSO_4$.

SOLUBILITY IN WATER.

(Cottrell — J. Physic. Ch. 4, 651, '01; Richards and Fraprie — Am. Ch. J. 26, 77, '01. The results of Linebarger — Am. Ch. J. 15, 225, '93, were shown to be incorrect by Cottrell, and this conclusion was confirmed by R. and F.)

t°.	Grams $MnSO_4$ per 100 Gms. Water.	Grams $MnSO_4$ per 100 Gms. Solution.	Solid Phase.	t°.	Grams $MnSO_4$ per 100 Gms. Water.	Grams $MnSO_4$ per 100 Gms. Solution.	Solid Phase.
−10	47.96	32.40	$MnSO_4.7H_2O$	16	63.94	38.99	$MnSO_4.4H_2O$
0	53.23	34.73	"	18.5	64.19	39.10	"
5	56.24	35.99	"	25	65.32	39.53	"
9	59.33	37.24	"	30	66.44	39.93	"
12	61.77	38.19	"	39.9	68.81	40.77	"
14.3	63.93	39.00	"	49.9	72.63	42.08	"
5	58.06	36.69	$MnSO_4.5H_2O$	41.4	60.87	37.84	$MnSO_4.H_2O$
9	59.19	37.18	"	50	58.17	36.76	"
15	61.08	37.91	"	60	55.0	35.49	"
25	64.78	39.31	"	70	52.0	34.22	"
30	67.76	40.38	"	80	48.0	32.43	"
35.5	71.61	41.74	"	90	42.5	29.83	"
				100	34.0	24.24	"

SOLUBILITY OF MANGANESE SULFATE, COPPER SULFATE MIXED CRYSTALS IN WATER AT 18°.

(Stortenbecker, 1900.)

Mols. per 100 Mols. H_2O. Cu.	Mn.	Mol. per cent Cu in: Solution.	Crystals.	Mols. per 100 Mols. H_2O. Cu.	Mn.	Mol. per cent Cu in: Solution.	Crystals.
Solid Phase, $CuMnSO_4\,5H_2O$, Triclinic.				Solid Phase, $CuMnSO_4\,5H_2O$. Triclinic.			
2.282	0	100	100	[0.73	6.37	10.27	10.5]
...	...	90.5	...	...	...	5.0	4.9
2.23	0.44	83.5	...	0.34	7.03	4.60	...
...	...	74.1	97.3	...	...	2.31	2.15
...	...	57.7	95.1	...	7.375	0.0	0.0
...	...	31.0	81.3	Solid Phase. $CuMnSO_4$. Monoclinic. $7H_2O$.			
1.54	3.76	29.0	...				
...	...	26.1	70.4	...	...	20.4	28.2*
1.31	4.70	21.8	...	[1.06	5.58	15.9	23.5]
...	...	21.2	42.6	...	...	12.45	20.8
...	...	20.0	34.4	[0.73	6.37	10.27	16.0]
[1.06	5.58	15.9	22.9]	...	...	4.60	5.8*
...	...	13.9	15.2*	...	±8	0.0	0.0

* Indicates meta stabil points.

$CuMnSO_4.5H_2O$ = 100–90.8 and 2.11–0 mol. per cent Cu.
$CuMnSO_4.7H_2O$ = 37.8–4.92 mol. per cent Cu.

SOLUBILITY OF MANGANESE SULFATE IN GLYCOL.

100 gms. saturated solution contain 0.5 gm. $MnSO_4$. (de Coninck, 1905.)

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM SULFATE AT 25° AND 50° AND VICE VERSA.
(Schreinemakers, 1909.)

Results at 25°.

Gms. per 100 Gms. Sat. Sol. $MnSO_4$.	$(NH_4)_2SO_4$.	Solid Phase.
39.3	0	$MnSO_4.5H_2O$
38.49	3.64	" $+D_6$
33.44	4.91	D_6
22.06	9.65	"
9.02	20.36	"
2.91	37.42	"
1.75	42.58	" $+(NH_4)_2SO_4$
1.77	43.24	$(NH_4)_2SO_4$
0	43.4	"

$D_6 = MnSO_4.(NH_4)_2SO_4.6H_2O$.

Results at 50°.

Gms. per 100 Gms. Sat. Sol. $MnSO_4$.	$(NH_4)_2SO_4$.	Solid Phase.
36.26	0	$MnSO_4.H_2O$
35.35	2.95	" $+D_{2.1}$
30.57	5.14	$D_{2.1}$
16.86	17.62	"
6.92	35.98	"
6.29	39.71	"
5.70	43.24	" $+(NH_4)_2SO_4$
3.49	44.02	$(NH_4)_2SO_4$
0	45.7	"

$D_{2.1} = (MnSO_4)_2(NH_4)_2SO_4$.

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AT 35° AND VICE VERSA.
(Schreinemakers and Provije, 1913.)

Gms. per 100 Gms. Sat. Sol $MnSO_4$.	Na_2SO_4	Solid Phase.
39.45	0	$MnSO_4.H_2O$
33.92	5.23	"
33.06	7.97	" $+(MnSO_4)_9.(Na_2SO_4)_{10}$
32.92	7.42	" "
31.05	9.20	$(MnSO_4)_9.(Na_2SO_4)_{10}$
27.67	10.76	"
22.14	14.28	"
14.58	20.01	"

Gms. per 100 Gms. Sat. Sol. $MnSO_4$.	Na_2SO_4	Solid Phase.
13.96	21.91	$(MnSO_4)_9.(Na_2SO_4)_{10}$ " $+MnSO_4(Na_2SO_4)_3$
12.19	22.49	$MnSO_4.(NaSO_4)_3$
10.45	23.41	"
7.43	26.58	"
5.69	29.31	"
5.11	30.52	" $+Na_2SO_4$
2.96	31.33	
0	33	

Data for the solubility of mix crystals of manganese and zinc sulfates between 0° and 39° are given by Sahmen, 1905–06.

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS ETHYL ALCOHOL.
(Schreinemakers, 1909; Schreinemakers and Deuse, 1912)

Results at 25°.

Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	$MnSO_4$.	Solid Phase.
0	39.3	$MnSO_4.5H_2O$
6.81	33.72	"
liquid layers separate here		
53.09	1.23	"
57.39	0.56	"
76.70	0	$MnSO_4.H_2O$

Results at 50°.

Gms. per 100 Gms Sat Sol. C_2H_5OH.	$MnSO_4$	Solid Phase.
0	36.26	$MnSO_4.H_2O$
6.67	28.12	"
16.02	18.75	"
22.63	12.54	"
36.47	4.12	"

Composition of the liquid layers.

Water rich Layer. %C_2H_5OH.	%$MnSO_4$.	C_2H_5OH rich Layer. %C_2H_5OH.	%$MnSO_4$.
6.81	33.72*	53.09	1.23*
8.48	31.51	49.76	1.83
15.02	22.61	32.75	8.01

The following reciprocally saturated metastable solutions were obtained at 50°.

Water rich Layer. % C_2H_5OH.	% $MnSO_4$.	C_2H_5OH rich Layer. % C_2H_5OH.	% $MnSO_4$.
5.68	34.95	53.64	0.97
7.69	30.99	45.83	2.19
8.70	29.20	41.93	3.11
11.85	24.84	35.15	5.95

* These liquids in contact with $MnSO_4.5H_2O$.

Similar data are also given for 30° and for 35°. Both stable and metastable liquid pairs were obtained at these intermediate temperatures.
Additional data for this system are also given by Cuno, 1908.

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS ETHYL ALCOHOL (CON.).

Composition of the conjugated liquids in contact with excess of solid salt.

t°.	C_2H_5OH rich Layer.		Aqueous rich Layer.		Solid Phase.
	% C_2H_5OH.	% $MnSO_4$.	% C_2H_5OH.	% $MnSO_4$.	
10	37.06	5.44	13.78	25.25	$MnSO_4.5H_2O$
15	44.56	2.79	9.25	29.79	"
17.	47.11	2.22	8.53	30.88	"
21	53.55	1.10	6 10	35.05	"
25	53.09	1.23	6.81	33.72	"
30	45.20	2.49	8.69	30.15	$MnSO_4.H_2O$
31	43.90	2.74	8.47	30.10	"
35	41.71	3.44	9.24	28.61	"
37	38.26	4.84	11.03	26 47	"
41	34.01	5.86	11 93	24.97	"
42	32.37	6.89	13.57	23.09	"
43	31.42	8.51	14.33	22.01	"

Data for the solubility of manganese sulfate and potassium iodate in methyl alcohol are given by Karplus, 1907.

SOLUBILITY OF MANGANESE SULFATE IN AQUEOUS ETHYL AND PROPYL ALCOHOL SOLUTIONS AT 20°.

(Linebarger, 1892; Snell, 1898.)

Conc. of Alcohol in Wt. per cent.	Gms. $MnSO_4$ per 100 Gms. Aq. Ethyl Alc.	Propyl Alc.	Conc of Alcohol in Wt. per cent.	Gms. $MnSO_4$ per 100 Gms. Aq. Ethyl Alc.	Propyl Alc.
34	9.5	6	44	3.3	1.9
36	7.2	4.6	48	2.2	1.4
38	5.8	3.5	52	1.4	1.1
40	4.7	2.8			

100 cc. anhydrous hydrazine dissolve about 1 gm. $MnSO_4$ at room temp. (Welsh and Broderson, 1915.)

Fusion-point data for mixtures of $MnSO_4 + K_2SO_4$, and $MnSO_4 + Na_2SO_4$ are given by Calcagni and Marotta, 1914.

MANGANESE SULFIDE MnS.

One liter sat. solution in water contains $71.6.10^{-6}$ mols. MnS = 0.00623 gm. per liter at 18° by conductivity method. (Weigel, 1907; see also Bruner and Zawadzki, 1909.)

MANGANESE Potassium **VANADATE** $MnKV_5O_{14}.8H_2O$.

100 gms. H_2O dissolve 1.7 gms. salt at 18°. (Radan, 1889.)

MANNITOL $CH_2OH(CHOH)_4CH_2OH$.

SOLUBILITY IN WATER.

(Findlay, 1902.)

t°.	Gms. $CH_2OH(CHOH)_4CH_2OH$ per 100 Gms. H_2O.	t°.	Gms. $CH_2OH(CHOH)_4CH_2OH$ per 100 Gms. H_2O.
0	7.59	40	35.4
10	11.63 (13.94 gms. Campetti, 1901)	50.8	46.69
20	17.71 (18.98 gms. Campetti, 1901)	60	60.01
24.5	20.96	70	74.5
30	25.4	80	91.5
35.8	29.93	100	133.1

100 gms. alcohol, Sp. Gr. 0.905, dissolve 1.56 gms. mannitol at 14°. (Krusemann, 1876.)

Data for the solubility of mannitol at high pressures are given by Cohen, Inouye and Euwen, 1910.

100 gms. sat. sol. in pyridine contain 0.47 gm. mannitol at 26°. (Holty, 1905.)

100 gms. aq. 50% pyridine dissolve 2.46 gms. mannitol at 20–25°. (Dehn, 1917.)

Data for the ternary systems mannitol + succinic acid nitrile + water and mannitol + triethylamine + water, are given by Timmermans, 1907.

MERCURY ACETATE (ic) $Hg(C_2H_3O_2)_2$, (ous) $Hg_2(C_2H_3O_2)_2$.

100 gms. water dissolve 25 gms. mercuric acetate at 10°.

100 gms. water dissolve 0.75 gm. mercurous acetate at 13°.

100 cc. anhydrous hydrazine dissolve about 2 gms. mercurous acetate at room temp. with precipitation of Hg. (Welsh and Broderson, 1915.)

MERCURY BENZOATE (ic) $(C_6H_5COO)_2Hg.?H_2O$.

100 gms. H_2O dissolve 1.2 gms. mercuric benzoate at 15° and 2.5 gms. at 100°. (Tarugi and Checchi, 1901.)

MERCURY BROMIDE (ic) $HgBr_2$.

SOLUBILITY IN WATER.

t°.	Gms $HgBr_2$ per 100 Gms H_2O.	Authority.
9	1.06	(Lassaigne, 1876.)
25	0.61	(Sherrill, 1903.)
100	20–25	(Lassaigne.)

Mercurous bromide. One liter sat. aq. solution contains 0.000039 gm. Hg_2Br_2 at 25°. (Sherrill, 1903.)

EQUILIBRIUM IN THE SYSTEM MERCURIC BROMIDE, AMMONIA, WATER AT 8°–10°.
(Gaudechon, 1910)

The mixtures were shaken intermittently for 21–48 hrs. Both the clear sat. solution and the separated and dried solid phases were analyzed.

Initial Mixture. Gms. Mols. per Liter.			Sat. Solution. Gms. Atoms. per Liter.			Solid Phase.
$HgBr_2$.	NH_3.	NH_4Br.	Hg.	Br.	N.	
0.0125	0.0250	0	trace	0.0154	0.0185	$(NHg_2Br)_4HgBr_2$
0.0166	0.0332	0	0.00032	0.0172	0.0202	36% " +64% NHg_2BrNH_4Br
0.025	0.050	0	0.00078	0.0241	0.0251	$NHg_2Br.NH_4Br$
0.050	0.100	0	0.0019	0.0525	0.0514	"
0.0125	0.025	0.0375	0.00178	0.0497	0.0497	"
0.025	0.050	0.075	0.0041	0.103	0.108	"
0.0328	0.0656	0.0984	0.0061	0.133	0.133	93% " +6% $NHgBr.3NH_4Br$
0.0365	0.073	0.1095	0.0060	0.132	0.133	36% " +64% $NHgBr.3NH_4Br$
0.050	0.100	0.150	0.007	0.170	0.169	$NHg_2Br.3NH_4Br$
0.100	0.200	0.300	0.0124	0.333	0.338	"
0.0180	0.036	0.01875	0.001	0.0315	0.0318	$NHg_2Br.NH_4Br$
0.050	0.100	0.006	0.0057	0.1172	0.1178	"
0.050	0.100	0.150	0.0071	0.169	0.168	$NHg_2Br.3NH_4Br$
0.100	0.200	0.160	0.0083	0.184	0.187	"
0.125	0.250	0.306	0.0160	0.393	...	"

SOLUBILITY OF MERCURIC BROMIDE IN AQUEOUS SALT SOLUTIONS AT 25°.
(Herz and Paul, 1913)

(The mixtures were constantly agitated for eight days.)

In Aq. $BaBr_2$. Mols. per Liter.		In Aq. $CaBr_2$. Mols. per Liter.		In Aq. KBr. Mols. per Liter.		In Aq. NaBr. Mols. per Liter.		In Aq. $SrBr_2$. Mols. per Liter.	
$BaBr_2$.	$HgBr_2$.	$CaBr_2$.	$HgBr_2$.	KBr.	$HgBr_2$.	NaBr.	$HgBr_2$.	$SrBr_2$.	$HgBr_2$.
0	0.017	0.072	0.117	0	0.017	0.118	0.078	0.062	0.104
0.274	0.370	0.645	0.676	0.209	0.098	0.596	0.285	0.328	0.471
0.396	0.540	1.892	1.358	0.770	0.472	1.142	0.540	0.668	0.902
0.579	0.759	2.479	2.766	2.380	1.360	2.448	1.276	1.401	1.770
1.096	1.478	3.754	3.666	3.470	1.930	5.246	2.306	1.872	2.238

The following slightly higher results for KBr solutions are given by Sherrill (1903).

Mols. KBr per liter	0	0.05	0.10	0.5	0.866	2	3	4
Mols. $HgBr_2$ per liter	0.017	0.055	0.088	0.0359	0.611	1.407	2.096	2.339

Data for equilibrium in the system $HgBr_2$ + KOH + H_2O at 25° are given by Herz (1910).

Solubility of Mercuric Bromide in Aqueous Solutions of Metyhl Alcohol, Ethyl Alcohol and of Ethyl Acetate at 25°.

(Herz and Anders, 1907.)

In Aq. Methyl Alcohol.			In Aq. Ethyl Alcohol.			In Aq. Ethyl Acetate.		
Wt. % CH_3OH in Solvent.	d_{25} of Sat. Sol.	Gms. $HgBr_2$ per 100 cc. Sat. Sol.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $HgBr_2$ per 100 cc. Sat. Sol.	Wt. % $CH_3CO_2C_2H_5$ in Solvent.	d_{25} of Sat. Sol.	Gms. $HgBr_2$ per 100 cc. Sat. Sol.
10.6	0.9857	0.72	0	1.0022	0.60	0	1.0022	0.60
30.77	0.9588	1.29	20.18	0.9717	0.67	4.39	1.0018	0.574
47.06	0.9401	2.52	40.69	0.9435	1.59	96.76	1.1159	26.69
64	0.9386	6.85	70.01	0.9214	6.58	100	1.0113	14.13
78.05	0.9744	14.66	100	0.9873	22.81			
100	1.2275	50.25						

100 gms. sat. sol. in 95% C_2H_5OH (d_{15} = 0.8126) contain 13.2 gms. $HgBr_2$ at 0°, 16.53 gms. at 25° and 22.63 gms. at 50°. (Reinders, 1900.)

Solubility of Mercuric Bromide in Alcohols.

(Timofeiew, 1894.)

In Methyl Alcohol.		In Ethyl Alcohol.		In Propyl Alcohol.		In Isobutyl Alcohol.	
t°.	Gms. $HgBr_2$ per 100 Gms. CH_3OH.	t°.	Gms. $HgBr_2$ per 100 Gms. C_2H_5OH.	t°.	Gms. $HgBr_2$ per 100 Gms. C_3H_7OH.	t°.	Gms. $HgBr_2$ per 100 Gms. C_4H_9OH.
0	41.15	0	25.2	0	14.6	0	4.61
10	49.5	10	26.3	10	15.6	10	5.63
19	66.3	19	29.7	19	15.5	23	6.65
22	60.9	39	31.9	39	20.8	39	9.58
39	71.3	65	44.5	65	31.3	65	15.80
65	90.8	89	66.9	86.5	42.7		
97	139.1						

Solubility of Mercuric Bromide in Mixtures of Alcohols at 25°.

(Herz and Kuhn, 1908.)

In Mixtures of Methyl and Ethyl Alcohols.			In Mixtures of Methyl and Propyl Alcohols.			In Mixtures of Ethyl and Propyl Alcohols.		
% CH_3OH in Mixture.	d_{25} of Sat. Sol.	Gms. $HgBr_2$ per 100 cc. Sat. Sol.	% C_3H_7OH in Mixture.	d_{25} of Sat. Sol.	Gms. $HgBr_2$ per 100 cc Sat Sol	% C_3H_7OH in Mixture.	d_{25} of Sat Sol.	Gms. $HgBr_2$ per 100 cc. Sat Sol.
0	0.9873	22.8	0	1.227	50.20	0	0.9873	22.80
4.37	0.9932	23.1	11.11	1.1954	47.28	8.1	0.9802	22.25
10.4	1.009	25.4	23.8	1.1524	41.53	17.85	0.9740	21.06
41.02	1.080	33.3	65.2	1.0257	25.30	56.6	0.9487	17.63
80.69	1.185	45.7	91.8	0.9437	16.35	88.6	0.9269	14.76
84.77	1.193	46.8	93.75	0.9368	15.86	91.2	0.9239	14.64
91.25	1.211	48.6	96.6	0.9275	14.66	95.2	0.9227	14.06
100	1.227	50.2	100	0.9213	13.78	100	0.9213	13.78

Solubility of Mercuric Bromide in Organic Solvents.

In Carbon Disulfide. (Arctowski, 1894.)

t°.	Gms. $HgBr_2$ per 100 Gms. Solution.	t°.	Gms. $HgBr_2$ per 100 Gms. Solution.
−10	0.049	15	0.140
− 5	0.068	20	0.187
0	0.087	25	0.232
+ 5	0.105	30	0.274
10	0.122		

In Other Solvents at 18°-20°. (Sulc, 1900.)

Solvent.	Formula.	Gms. $HgBr_2$ per 100 Gms. Solvent.
Chloroform	$CHCl_3$	0.126
Bromoform	$CHBr_3$	0.679
Carbon Tetrachloride	CCl_4	0.003
Ethyl Bromide	C_2H_5Br	2.31
Ethylene Dibromide	$C_2H_4Br_2$	2.34

One liter benzene dissolves 6.99 gms. $HgBr_2$ at 25°. (Abegg and Sherrill, 1903.)

SOLUBILITY OF MERCURIC BROMIDE IN AN EQUIMOLECULAR MIXTURE OF ETHYL ALCOHOL AND BENZENE. (Dukelski, 1907.)

t°.	0.	10.	20.	30.	40.	50.	60.
Gms. $HgBr_2$ per 100 Gms. Sat. Sol.	10.7	12	14	16	17.5	19	21

100 gms. of sat. sol. in acetone at 25° contain 34.76 gms. $HgBr_2$. (Reinders, 1900.)

SOLUBILITY OF MERCURIC BROMIDE IN ANILINE. (Staronka, 1910.)

t°.	Mol. % $HgBr_2$.	Gms. $HgBr_2$ per 100 Gms. $C_6H_5NH_2$.	Solid Phase.	t°.	Mol. % $HgBr_2$.	Gms. $HgBr_2$ per 100 Gms. $C_6H_5NH_2$.	Solid Phase.
60	4	16.14	$HgBr_2.2C_6H_5NH_2$	110*	33.3	193.3	$HgBr_2.2C_6H_5NH_2$
70	5.8	23 83	"	109.7†	33.5	195	" $+HgBr_2.C_6H_5NH_2$
80	8.3	35 04	"	115	37.2	229.3	$HgBr_2.C_6H_5NH_2$
90	12.2	53 80	"	120	42.3	283.8	"
100	18.8	89 64	"	124	50	387.2	"
105	23.2	116.9	"	123	55.4	480.9	"

* M. pt. † Eutec.

100 gms. ethyl acetate dissolve 13.05 gms. $HgBr_2$ at 18°. (Naumann, 1910.)
100 gms. methyl acetate dissolve 21.93 gms. $HgBr_2$ at 18° (d_{18} sat. sol. = 1.090). (Naumann, 1909.)

SOLUBILITY OF MERCURIC BROMIDE IN PYRIDINE. (Staronka, 1910.)

t°.	Mol. % $HgBr_2$.	Gms. $HgBr_2$ per 100 Gms. C_5H_5N.	Solid Phase.	t°.	Mol. % $HgBr_2$.	Gms. $HgBr_2$ per 100 Gms. C_5H_5N	Solid Phase.
10	5	24	$HgBr_2.2C_5H_5N$	107*	39	291 5	$HgBr_2.2C_5H_5N+HgBr_2.C_5H_5N$
30	8	39.64	"	110	40 4	309	$HgBr_2.C_5H_5N$
50	11.2	57.49	"	120	45.5	381 3	"
80	17.5	96 68	"	123†	50	455.8	"
100	22	128.5	"	125	51	474 4	$3HgBr_2.2C_5H_5N$
110	24.5	147.8	"	130	54.2	539.4	"
118†	33.3	227.6	"	134†	60	683.7	"
110	35.5	250.8	"	133	64	810.4	"

* Eutec. † m. pt.

SOLUBILITY OF MERCURIC BROMIDE IN QUINOLINE. (Staronka, 1910.)

t°.	Mol % $HgBr_2$.	Gms. $HgBr_2$ per 100 Gms C_9H_7N.	Solid Phase.
88	4.4	12.85	$HgBr_2.2C_9H_7N$
111	8.9	27.28	"
127	14.3	46.58	"
134	17.6	61.16	"

Data for the solubility of mercuric bromide in nitrobenzene, in *p* nitrotoluene, in *m* nitrotoluene, in *o* nitrotoluene and in α nitronaphthalene, determined by the method of lowering of the freezing-point, are given by Mascarelli, 1906, and Mascarelli and Ascoli, 1907. Data for $HgBr_2$ + Se are given by Olivari, 1912.

DISTRIBUTION OF MERCURIC BROMIDE BETWEEN WATER AND BENZENE (THIOPHENE FREE) AT 25°. (Sherrill, 1903.)

Mols. per Liter.		Dist. Coef.	Mols. per Liter.		Dist. Coef.
H_2O Layer.	C_6H_6 Layer.		H_2O Layer.	C_6H_6 Layer.	
0.017	0.194	0.876	0.00634	0.0715	0.89
0.01147	0.1303	0.88	0.00394	0.0436	0.90
0.00953	0.1074	0.89	0.00320	0.0353	0.90

Data are also given for the distribution between aqueous potassium iodide solutions and thiophene free benzene at 25°.

Data for the solubility of mix crystals of $HgBr_2$ + HgI_2 in acetone at 25° and in ethyl alcohol of d_{15} = 0.8126 = 95% at 0°, 25° and 50° are given by Reinders (1900). In the case of acetone, the ratio of $HgBr_2$ in the solution increases with increase of per cent of $HgBr_2$ in the solid phase. In the case of the alcohol solutions the ratio in solution does not show such regular variations with change of per cent of $MgBr_2$ in the solid phase.

MERCURY CHLORIDE (ic) $HgCl_2$, (ous) Hg_2Cl_2.

SOLUBILITY OF MERCURIC CHLORIDE IN WATER.

Average curve from results of Etard, 1894; Foote, 1903; Osaka, 1903–08; Herz and Paul, 1913; Greenish and Smith, 1903; Schreinemakers and Thonus, 1912; Sherrill, 1903; Morse, 1902.

t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.
0	3.5	25	6.9	80	23.1
10	4.6	30	7.7	100	38
15.5	5.3 (d_{15} = 1.047)	40	9.3	120	59
20	6.1	60	14	150	78.5

SOLUBILITY OF MERCUROUS CHLORIDE IN WATER.

t°.	Gms. Hg_2Cl_2 per 100 Gms. Sat. Sol.	Authority.	t°.	Gms. Hg_2Cl_2 per 100 Gms. Sat. Sol.	Authority.
0.5	0.000140	(Conductivity, Kohlrausch, 1908.)	24.6	0.00028	(Kohlrausch, 1908.)
18	0.000075	(Indirect, Behrend, 1893.)	25	0.000047	(Sherrill, 1903.)
18	0.00021	(Conductivity, Kohlrausch, 1908)	43	0.00070	(Kohlrausch, 1908.)
20	0.000038	(Ley and Heimbucher, 1904.)			

SOLUBILITY OF MERCURIC CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE.

(Homeyer and Ritsert — Pharm. Ztg. 33, 738, '88.)

Per cent Concentration of NaCl Solutions.	Gms. $HgCl_2$ per 100 Gms. NaCl Solution at: 15°	65°	100°
0.5	10	13	44
1.0	14	18	48
5.0	30	36	64
10.0	58	68	110
25.0.	120	142	196
26.0 (saturated)	128	152	208

SOLUBILITY OF MERCURIC CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT:

0°.

(Engel — Ann. chim. phys. [6] 17, 362, '89.)

Mg. Mols. per 100 cc. Sol. HCl.	Mg. Mols. per 100 cc. Sol. ½HgCl.	Gms. per 100 cc. Sol. HCl.	Gms. per 100 cc. Sol. $HgCl_2$.	Sp. Gr. of Solutions.
4.3	9.7	1.57	13.11	1.117
9.9	19.8	3.61	18.04	1.238
17.8	35.5	6.49	32.44	1.427
26.9	55.6	9.81	49.04	1.665
32.25	68.9	11.76	58 80	1.811
34.25	72.4	12.48	62 40	1.874
41.5	85 5	15.13	75.65	2 023
48.1	88 6	17.54	87.70	2.066
70.9	95.7	25.84	129.20	2.198

20–25° (?).

(Ditte — *Ibid.* [5] 22, 551, '81.)

Parts HCl per 100 Parts H_2O.	Parts $HgCl_2$ per 100 Parts Solution
0.0	6.8
5.6	46.8
10.1	73.7
13.8	87.8
21.1	127.4
31.0	141.9
50.0	148.0
68.0	154.0

One liter of 0.1 *n* $Hg(NO_3)_2$ solution dissolves 105 gms. $HgCl_2$ at 25°. (Morse, 1902.)

This result, together with distribution experiments, show that complexes of $HgCl_2$ and $Hg(NO_3)_2$ are formed.

SOLUBILITY OF MERCURIC CHLORIDE IN AQUEOUS SALT SOLUTIONS AT 25°.

(Herz and Paul, 1913.)

In Aqueous Barium Chloride.		In Aqueous Calcium Chloride.		In Aqueous Lithium Chloride.		In Aqueous Magnesium Chloride.	
Mols. per Liter.		Mols per Liter.		Mols. per Liter.		Mols. per Liter.	
$BaCl_2$.	$HgCl_2$.	$CaCl_2$.	$HgCl_2$.	LiCl.	$HgCl_2$.	$MgCl_2$.	$HgCl_2$.
0	0.265	0.190	0.364	0.414	0.351	0.168	0.374
0.385	0.697	0.402	0.766	0.835	0.666	0.415	0.719
0.572	1.167	0.656	1.108	1.271	1.021	0.570	1.131
0.776	1.620	0.964	1.811	1.738	1.678	0.997	1.864
1.336	2.645	1.429	2.645	2.265	2.214	1.320	2.569
3.030	5.348	1.723	3.304	3.091	2.896	1.728	3.206

In Aqueous Potassium Chloride.			In Aqueous Sodium Chloride.		In Aqueous Strontium Chloride.	
Mols. per Liter.			Mols per Liter.		Mols. per Liter.	
KCl.	$HgCl_2$.		NaCl.	$HgCl_2$.	$SrCl_2$.	$HgCl_2$.
0	0.265		0.201	0.372	0.164	0.315
0.1	0.381	(Sherrill, 1903.)	0.416	0.508	0.311	0.563
0.174	0.355		0.671	0.748	0.519	0.829
0.221	0.381		1.153	1.192	0.724	1.342
0.25	0.542	(Sherrill, 1903.)	1.941	2.022	1.046	1.776
0.683	0.836		3.162	3.434	1.384	2.293

SOLUBILITY OF MERCURIC CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 20° AND VICE VERSA.

(Tichomirow, 1907; see also results by Foote and Levy on next page.)

Gms. per 100 Gms. H_2O.		Solid Phase.	Gms per 100 Gms H_2O.		Solid Phase.
KCl.	$HgCl_2$.		KCl	$HgCl_2$.	
0	7.39	$HgCl_2$	20.35	29	$HgCl_2.KCl$
1.12	11.63	"	26.31	34.83	"
2.39	15.72	"	30.32	39.10	"
4.05	22.17	"	34.12	42.82	" $+HgCl_2.2KCl$
4.84	25.16	" $+2HgCl_2.KCl$	34.18	39.34	$HgCl_2.2KCl$
5.60	25.13	$2\ HgCl_2.KCl$	34.34	35.16	"
6.71	25.66	"	35.54	30.63	"
7.39	26.41	" $+HgCl_2.KCl$	37.72	24.30	"
7.46	24.70	$HgCl_2.KCl$	41.33	19.33	" $+KCl$
8.95	19.93	"	39.66	15.76	KCl
15	22.87	"	37.87	10.28	"
17.57	26.12	"	35.32	2.1	"

100 gms. 1 *n* aq. NaCl solution dissolve 25.08 gms. $HgCl_2$ at 25°.

(Osaka, 1903–08.)

Data for the solubility of mercuric chloride in aqueous solutions of glycerol, sucrose, tartaric and citric acids at 25° are given by Moles and Marquina, 1914.

Data for equilibrium in the system $HgCl_2 + KOH + H_2O$ at 25° are given by Herz, 1910.

Similar data for mercurous chloride + KOH + H_2O at 25° are given by Herz, 1911.

SOLUBILITY OF MIXTURES OF SODIUM AND MERCURIC CHLORIDE IN WATER AT 25°.

(Foote and Levy — Am. Ch. J. 35, 239, '06.)

Gms. per 100 Gms. Solution.		Gms. per 100 Gms. Undissolved Residue.			Solid Phase.
NaCl.	$HgCl_2$.	NaCl.	$HgCl_2$.	H_2O.	
26.5	none	100	none	none	NaCl
18.66	51.35	...	16.39	...	NaCl and $NaCl.HgCl_2.2H_2O$
18.71	51.32	...	21.98	...	"
18.64	51.42	...	65.42	...	"
18.87	51.26	...	71.25	...	"
14.97	57.74	16.38	74.18	9.44	Double Salt $NaCl\ HgCl_2.2H_2O$ Calc. Comp = 16.01% NaCl 74.14% $HgCl$ 9.85% H_2O
14.03	59.69	16.36	74.21	9.43	"
13.25	62.16	16.16	74.70	9.14	"
13.17	62.59	15.96	74.76	9.28	"
12.97	62.50	...	78.20	...	$NaCl\ HgCl_2.2H_2O$ and $HgCl_2$
13.14	62.48	...	88.64	...	"
13.15	62.55	...	90.83	...	"
Two determinations made at 10.3° gave:					
19.46	46.49	67.46	29.19	3.35	
19.48	46.50	22.83	68.85	8.32	

SOLUBILITY OF MIXTURES OF POTASSIUM AND MERCURIC CHLORIDES IN WATER AT 25°.

(Foote and Levy)

Composition of Solution. Grams per 100 Grams Solution.		Percentage Composition of Undissolved Residue			Solid Phase.
KCl.	$HgCl_2$.	KCl.	$HgCl_2$.	H_2O.	
26.46	none	100	none	..	KCl
26.24	15.04	...	3.63	...	KCl and $2KCl.HgCl_2.H_2O$
26.43	15.02	...	26.15	...	"
26.33	15.02	...	52.01	...	"
26.33	14.92	...	61.04	...	"
23.74	18.91	34.61	61.66	3.73	$2KCl\ HgCl_2.H_2O$ Calc. Composition 34.05% KCl, 61.84% $HgCl_2$, 4.11% H_2O
22.36	21.39	34.77	62.02	3.21	"
21.39	23.88	34.80	61.84	3.35	"
20.32	27.62	...	65.24	...	$2KCl\ HgCl_2\ H_2O$ and $KCl\ HgCl_2.H_2O$
20.26	27.38	...	73.98	...	"
17.85	25.34	21.89	75.10	3.01	$KCl\ HgCl_2.H_2O$ Calc. Composition 20.52% KCl, 74.53% $HgCl_2$, 4.95% H_2O
9.26	18.95	21.02	73.36	5.62	"
7.80	19.56	20.76	73.06	6.18	"
6.84	22.81	20.75	74.54	4.71	"
6.66	24.32	20.54	73.99	5.47	"
6.52	25.13	..	76.46	..	$KCl\ HgCl_2.H_2O$ and $KCl\ 2HgCl_2\ 2H_2O$
6.64	25.16	...	80.60	...	"
6.27	25.11	12.09	83.20	4.71	$KCl.2HgCl_2.2H_2O$ Calc. Composition 11.43% KCl, 83.05% $HgCl_2$, 5.52% H_2O
5.77	24.73	11.87	83.18	4.95	"
4.68	24.75	...	84.46	...	$KCl.2HgCl_2.2H_2O$ and $HgCl_2$
4.66	25.17	...	93.68	...	"
4.69	24.82	...	98.50	...	"
none	6.90	none	100.00	none	$HgCl_2$

Solubility of Mixtures of Mercuric and Rubidium Chlorides in Water at 25°.

(Foote and Levy, 1906.)

Composition of Solution. Gms. per 100 Gms. Solution. RbCl.	$HgCl_2$.	Percentage Composition of Undissolved Residue. RbCl.	$HgCl_2$.	H_2O.	Solid Phase.
48.57	none	100	none	none	RbCl
46.76	9.18	88.04	11.24	0.72	RbCl and $2RbCl.HgCl_2.H_2O$
47.54	9.49	60.33	37.51	2.16	
47.55	9.39	56.59	40.75	2.66	
47.3	9.47	46.73	49.38	3.88	
47.65	10.35	46.50	50.92	2.58	$2RbCl.HgCl_2.H_2O$ Calc. Composition 45.55% RbCl, 51.05% $HgCl_2$, 3.4% H_2O
35.16	19.58	45.98	50.80	3.22	
34.77	19.94	43.07	52.44	4.49	$2RbCl.HgCl_2.H_2O$ and $3RbCl.2HgCl_2.2H_2O$
34.76	20.10	41.10	55.36	3.54	
30.27	20.17	39.07	57.34	3.59	$3RbCl.2HgCl_2.2H_2O$ Calc. Composition 38.55% RbCl, 57.62% $HgCl_2$, 3.82% H_2O
29.20	20.55	39.10	57.47	3.43	
27.38	20.63	38.67	57.40	3.93	
26.83	20.87	38.48	57.36	4.16	$3RbCl.2HgCl_2.2H_2O$ and $RbCl.HgCl_2.H_2O$
27.09	20.97	31.40	64.35	4.25	
26.15	20.58	30.34	65.48	4.18	$RbCl.HgCl_2.H_2O$ Calc. Composition 29.49% RbCl, 66.11% $HgCl_2$, 4.40% H_2O
23.81	18.71	30.87	65.10	4.03	
18.10	14.25	29.87	65.28	4.85	
10.87	10.42	29.33	66.15	4.52	
10.68	10.56	28.59	67.99	3.42	$RbCl.HgCl_2.H_2O$ and $3RbCl.4HgCl_2.H_2O$
10.50	10.05	26.22	72.20	1.58	
10.06	9.86	25.28	73.38	0.84	$3RbCl.4HgCl_2.H_2O$ Calc. Composition 24.76% RbCl, 74.01% $HgCl_2$, 1.23% H_2O
8.48	8.71	25.30	73.15	1.55	
8.46	8.80	25.44	73.67	0.89	
5.68	8.70	25.09	73.46	1.45	
5.10	8.33	24.92	73.93	1.15	
3.43	8.25	22.79	75.72	1.49	$3RbCl.4HgCl_2.H_2O$ and $RbCl.5HgCl_2$
3.38	8	12.68	86.74	0.58	
2.98	7.71	8.40	91.24	...	$RbCl.5HgCl_2$ Calc. Composition 8.20% RbCl, 91.8% $HgCl_2$
1.89	7.64	8.38	91.78	...	
1.50	7.55	8.30	91.81	...	
1.10	7.21	8.07	91.58	...	
0.79	7.16	6.91	93.15	...	$RbCl.5HgCl_2$ and $HgCl_2$
0.84	7.42	2.27	97.09	...	
none	6.90	none	100	...	$HgCl_2$

Solubility of Mercuric Chloride in Acetic Acid.

(Etard, 1894.)

t°.	Gms. $HgCl_2$ per 100 Gms. Solution.	t°.	Gms. $HgCl_2$ per 100 Gms. Solution.	t°.	Gms. $HgCl_2$ per 100 Gms. Solution.
20	2.5	70	8.5	110	13.6
30	3.5	80	9.7	120	16.5
40	4.7	90	11	130	20.7
50	6	100	12.4	140	25.2
60	7.2			160	34.8

SOLUBILITY OF MERCUROUS CHLORIDE (CALOMEL) IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE, BARIUM CHLORIDE, CALCIUM CHLORIDE AND OF HYDROCHLORIC ACID AT 25°.

(Richards and Archibald, 1902.)

Solid phase in each case. Calomel + about 0.1 gm. of mercury.

In Aqueous NaCl.

Sp. Gr. of Solutions.	Gms. per Liter. NaCl.	Gms. per Liter. HgCl.
...	5.85	0.0041
1.040	58.50	0.041
1.078	119	0.129
1.093	148.25	0.194
1.142	222.3	0.380
1.188	292.5	0.643

In Aqueous $BaCl_2$.

Sp. Gr. of Solutions.	Gms. per Liter. $BaCl_2$.	Gms. per Liter. HgCl.
1.088	104.15	0.044
1.134	156.22	0.088
1.174	208.30	0.107
1.263	312.54	0.231

In Aqueous $CaCl_2$.

Sp. Gr. of Solutions.	Gms per Liter. $CaCl_2$.	Gms per Liter. HgCl.
...	39.96	0.022
...	55.5	0.033
1.064	111	0.081
1.105	138.75	0.118
1.151	195.36	0.231
1.205	257.52	0.322
1.243	324.67	0.430
1.315	432.9	0.518
1.358	499.5	0.510

In Aqueous HCl.

Sp. Gr. of Solutions.	Gms per Liter. HCl.	Gms per Liter. HgCl.
...	31.69	0.034
...	36.46	0.048
1.042	95.43	0.207
1.069	158.4	0.399
1.091	209.2	0.548
1.114	267.3	0.654
1.119	278.7	0.675
1.132	317.3	0.670
1.153	364.6	0.673

100 gms. bromoform, $CHBr_3$, dissolve 0.055 gm. HgCl at 18°-20°. (Sulc., 1900.)

SOLUBILITY OF MERCURIC CHLORIDE IN AQUEOUS ETHYL ALCOHOL AT 25°.

(Abe, 1912)

Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	Gms. per 100 Gms. Sat. Sol. $HgCl_2$.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	Gms. per 100 Gms. Sat. Sol. $HgCl_2$.	Solid Phase.
0	6.80	$HgCl_2$	45.84	15.36	$HgCl_2$
5.08	6.65	"	49.86	18.18	"
14.49	6.41	"	53.61	21.40	"
21	6.55	"	57.26	24.51	"
26.25	7.31	"	60.55	27.67	"
31.53	8.51	"	63.95	29.86	"
36.85	10.32	"	67.39	32.40	"
41.36	12.64	"			

SOLUBILITY OF MERCURIC CHLORIDE IN AQ. ETHYL ALCOHOL AT 25°.

(Herz and Anders, 1907.)

Wt. % C_2H_5OH in Solvent.	$d_{\frac{25}{4}}$ of Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. $HgCl_2$ per 100 cc. Sat. Sol.
0	0.9971	1.0565	7.22
20.18	0.9665	1.0214	6.76
40.69	0.9302	1.0180	10.69
70.01	0.8632	1.0616	23.60
100	0.7856	1.1067	36.86

Solubility of Mercuric Chloride in Aqueous Methyl Alcohol at 25°.

(Herz and Anders, 1907.)

Wt. % CH_3OH in Solvent.	$d_{\frac{25}{4}}$ of Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. $HgCl_2$ per 100 cc. Sat. Sol.
10.60	0.9792	1.0441	7.90
30.77	0.9481	1.0420	11.31
37.21	0.9369	1.0507	13.43
47.06	0.9186	1.0809	19.71
64	0.8800	1.2015	38.44
78.05	0.8489	1.3314	57.17
100	0.7879	1.2160	48.62

100 cc. 90% ethyl alcohol dissolve 27.5 gms. $HgCl_2$ at 15.5°, d_{15} sat. sol. = 1.065. (Greenish and Smith, 1903.)

100 gms. 99.2% ethyl alcohol dissolve 33.4 gms. $HgCl_2$ at 25°. (Osaka, 1903–8.)

" abs. " " " 49.5 " " " . (de Bruyn, 1892.)

" " methyl " " 52.9 " " at 19.5° and 66.9 gms. at 25°. (de Bruyn, 1892.)

" " " " " 1.2 " " at the crit. temp. (Centnerszwer, 1910.)

Solubility of Mercuric Chloride in Methyl, Ethyl Propyl, *n* Butyl, Iso Butyl and Allyl Alcohols.

(Etard — Ann. chim. phys. [7] 2, 563, '94.)

Note. — For the solubility in Me, Et, and propyl alcohols at room temperature, see Rohland — Z. anorg. Ch. **18**, 328, '98; at 8.5°, 20° and 38.2°, see Timofejew — Compt. rend. **112**, 1224, '91; in Me and Et alcohols at 25°, see de Bruyn — Z. physik. Ch. **10**, 783, '92. The determinations of these investigators agree well with those of Etard, which are given below.

t°.	Grams $HgCl_2$ per 100 Grams Saturated Solution in: CH_3OH.	C_2H_5OH.	C_3H_7OH.	$CH_3(CH_2)_3OH$.	$(CH_3)_2CHCH_2OH$.	$CH_2.CH.CH_2OH$.
−30	...	14.5	15.0	...	...	...
−20	...	20.1	15.7	13.5	...	21.0
−10	15.2	26.5	16.5	13.7	...	25.5
0	20.1	29.8	17.4	14.0	5.2	30.0
+10	26.3	30.6	18.0	14.3	6.0	37.5
20	34.0	32.0	18.8	14.6	6.8	46.5
25	40.0	32.5	19.5	15.5	7.2	...
30	44.4	33.7	20.0	16.5	7.5	...
40	58.6	35.6	23.0	19.6	9.7	...
60	62.5	41.2	29.8	26.5	17.0	...
80	66.0	47.5	36.8	33.0	24.9	...
100	70.1	54.3	43.8	...	31.7	...
120	73.5	61.5	50.6	...	39.2	...
150	78.5	...	...	...	...	...

Solubility of Mercuric Chloride in Aq. Ethyl Acetate at 25°.

(Herz and Anders, 1907.)

Wt. % $CH_3COOC_2H_5$ in Solvent.	$d_{\frac{25}{4}}$ of Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. $HgCl_2$ per 100 cc. Sat. Sol.
0	0.9971	1.0565	7.22
4.39*	...	1.0581	7.38
96.76†	...	1.2371	41.55
100‡	0.884	1.1126	26.42

* Almost sat. with ethyl acetate. † Ethyl acetate almost sat. with H_2O. ‡ (b. pt. = 75.77°.)

Solubility of Mercuric Chloride in Water-Ether Mixtures at 25°.

(Abe, 1912)

Gms. per 100 Gms. Sat. Sol.			Solid Phase.
$HgCl_2$.	Ether.	H_2O.	
6.92	87.86	5.22*	$HgCl_2$
5.2	1.2	93.6	"
4.3	5.2	90.5	"
2.8	5.4	91.8	"
1.5	5.4	93.1	"

* (Solvent, ether sat. with H_2O.)

Solubility of Mercuric Chloride in Mixtures of Ether and Ethyl Alcohol at 25°. (Abe, 1912.)

Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.	
$HgCl_2$.	C_2H_5OH	$HgCl_2$.	C_2H_5OH.
32.43	67.57	36.29	27.16
35.50	58.59	34.08	22.48
37.39	51.02	28.55	15.20
37.96	44.79	20.67	8.97
38.24	38.69	5.49	0
37.75	32.84		

Solubility of Mercuric Chloride in Mixtures of Alcohols at 25°.

(Herz and Kuhn, 1908)

In Mixtures of Ethyl and Methyl Alcohols.			In Mixtures of Ethyl and Propyl Alcohols.			In Mixtures of Methyl and Propyl Alcohols.		
% CH_3OH in Solvent.	d_{25} of Sat. Sol.	Gms $HgCl_2$ per 100 cc. Sat Sol.	% C_3H_7OH in Solvent.	d_{25} of Sat. Sol.	Gms. $HgCl_2$ per 100 cc. Sat. Sol.	% C_3H_7OH in Solvent	d_{25} of Sat. Sol	Gms $HgCl_2$ per 100 cc. Sat. Sol.
0	1.107	36.86	0	1.1070	36.86	0	1.2160	48.62
4.37	1.130	39.43	8.1	1.0988	36.67	11.11	1.2278	50.34
10.40	1.157	42.61	17.85	1.0857	34 06	23.80	1.2848	57.14
41.02	1.294	58.37	56.6	1.027[illegible]	27.11	65.20	1.1568	42.28
80.69	1.321	61.67	88.6	0.9854	21.66	91.80	1.0090	25.09
84.77	1.288	57.82	91.2	0.9824	21.60	93.75	1 0029	23 23
91.25	1.254	53.85	95.2	0.9772	20 87	96.6	0 9851	21.52
100	1.216	48.62	100	0.9720	20 03	100	0 9720	20.03

Solubility of Mercuric Chloride in Mixtures of Ethyl Alcohol and Benzene and of Ethyl Alcohol and Chloroform at Different Temperatures.

(Dukelski, 1907)

In a Mixture of one mol. C_2H_5OH + one mol. C_6H_6.		In a Mixture of two mols. C_2H_5OH + one mol. C_6H_6.		In a Mixture of one mol. C_2H_5OH + one mol. CH_3Cl.		In a Mixture of two mols. C_2H_5OH + one mol. $CHCl_3$.	
t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms $HgCl_2$ per 100 Gms. Sat Sol.	t°.	Gms $HgCl_2$ per 100 Gms Sat Sol.	t°.	Gms $HgCl_2$ per 100 Gms. Sat. Sol.
−2.5	15.20	−5.2	19.45	−20.5	3.82	−20.5	6.60
0	15.40	0	20.13	−12	4.43	0	7.69
6	16.38	9.1	21.65	0	4.89	8	8.96
20.5	18.40	20.9	23.57	8	5.37	23	10.66
20.65	18.50	24.4	24.19	23	7.12	38.5	12.50
24.5	19.33	36.5	26.53	38.5	8.51	44.2	14.40
34.5	21.34	53.7	31.27	44.2	9.51		
54.4	24.84	74	38.74	45.6	9.98		
54.5	24.42						

Some of the determinations were made by the direct method of saturating the solution at a given temperature and determining the dissolved material by evaporating and weighing. Others were made by the synthetic method of Alexejew.

SOLUBILITY OF MERCURIC CHLORIDE IN MIXTURES OF METHYL ALCOHOL AND CHLOROFORM, METHYL ALCOHOL AND CARBON TETRACHLORIDE, AND METHYL ALCOHOL AND DICHLORETHANE AT DIFFERENT TEMPERATURES.

(Dukelski, 1907)

In a Mixture of one mol. CH_3OH + one mol. $CHCl_3$.		In a Mixture of two mols. CH_3OH + one mol. $CHCl_3$.		In a Mixture of two mols. CH_3OH + one mol. CCl_4.		In a Mixture of two mols. CH_3OH + one mol. $C_2H_4Cl_2$.	
t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.
−12	1.73	−12	3.33	0	5.20	0	13.33
0	3.51	0	6.73	7.7	6.69	12.5	21.30
8	5.63	8	8.21	24.9	14.06	20.8	29.23
23	10.15	23	16.56	30.6	19.40	25.3	34.78
24.9	10.71	24.9	18.45	35.5	20.50	30.2	36.87
30.6	11.40	30.6	19.70	36.1	21.80	37.4	37.95
38.5	12.02	38.5	20.83	48.5	21.90	45.9	39.36

SOLUBILITY OF MERCURIC CHLORIDE IN MIXTURES OF METHYL ALCOHOL AND BENZENE AT DIFFERENT TEMPERATURES.

(Timofeiew, 1894)

In a Mixture of one mol. CH_3OH + one mol. C_6H_6.		In a Mixture of one mol. CH_3OH + two mols. C_6H_6.	
t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.
0	8	0	4.8
21–25	23.9	21–25	17.1
30	27.3	30	18
37	28.1	37	18.4

SOLUBILITY OF MERCURIC CHLORIDE IN BENZENE, IN DICHLORETHANE AND IN ETHYLACETATE AT DIFFERENT TEMPERATURES.

(Dukelski, 1907)

In C_6H_6.		In $C_2H_4Cl_2$.		In $CH_3COOC_2H_5$.	
t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms $HgCl_2$ per 100 Gms. Sat Sol.	t°.	Gms $HgCl_2$ per 100 Gms. Sat. Sol.
6.5	0.26	0	1.33	0	22.9
18	0.53	12.5	1.55	6.5	22.7
34.1	0.64	25.3	1.73	26.1	22.8
54.1	1.02	33	2.05	38.5	23.5
69	1.39	45.9	2.42	45.3	26.4

SOLUBILITY OF MERCURIC CHLORIDE IN MIXTURES OF BENZENE AND ETHYLACETATE, CHLOROFORM AND ETHYL ACETATE AND OF CARBON TETRACHLORIDE AND ETHYL ACETATE.

(Dukelski, 1907.)

In a Mixture of one mol. C_6H_6 + one mol. $CH_3COOC_2H_5$.		In a Mixture of one mol. $CHCl_3$ + one mol. $CH_3COOC_2H_5$.		In a Mixture of one mol. CCl_4 + two mols. $CH_3COOC_2H_5$.	
t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.
0	9.62	0	3.34	0	9.24
6.5	9.62	26.1	4.07	10.3	9.05
25.7	9.78	36.1	4.78	25.7	9.32
27.6	9.98	46	5.38	27.6	9.50
35.5	10.81	48.5	5.10	38.5	9.89
45.3	13.69			45.3	11.70

Solubility of Mercuric Chloride in Ethyl Acetate and in Acetone.

(Etard, 1894; von Laszcynski, 1894; Krug and McElroy, 1892; Linebarger, 1894; Aten, 1905–06.)

NOTE. — The results obtained by the above-named investigators were calculated to a common basis and plotted on cross-section paper. The variations which were noted could not be satisfactorily harmonized, consequently all the results are included in the following table:

Solubility.

t°.	In Ethyl Acetate. Grams $HgCl_2$ per 100 Grams Solution.				In Acetone. Gms. $HgCl_2$ per 100 Gms. Solution.			
	Laszcynski.	Aten.	Linebarger.	Etard.	K and McE.	Laszcynski.	Aten.	Etard.
−10	...	23.0	...	40	...	...	44.0 *	57.0
0	22.0	23.2	32.0	40	...	49.7	43.0 *	61.7
+10	22.2	23.5	32.5	40	...	52.0	51.0 *–58.9 †	61.7
20	22.5	23.4	32.7	40	...	54	58.5 †	61.7
25	22.7	23.5	33.0	40	37.4	55.2	58.2 †	61.7
30	23.0	...	33.2	40	...	...	...	61.7
40	23.5	...	33.5	40	...	...	...	61.7
50	24.0	...	33.5	41	...	...	...	61.7
60	24.7	...	...	42.5	...	...	...	61.7
80	26.0	...	...	45.2	...	...	...	61.7
100	...	...	...	48.0	...	...	...	...
120	...	...	...	50.8	...	...	...	...
150	...	...	...	55.0	...	...	...	...

(*) Solid phase $HgCl_2(CH_3)_2CO$. (†) Solid Phase $HgCl_2$.

100 gms. absolute acetone dissolve 143 gms. $HgCl_2$ at 18°. (Naumann, 1904.)

100 gms. ethyl acetate ($d_{\frac{18}{4}}$ = 0.8995) dissolve 48.8 gms. $HgCl_2$ at 18°. (Naumann, 1910.)

100 gms. methyl acetate ($d_{\frac{18}{4}}$ = 0.935) dissolve 42.6 gms. $HgCl_2$ at 18°. (Naumann, 1909.)

Solubility of Mercuric Chloride in Several Solvents.

(Arctowski, 1894; von Laszcynski, 1894; Sulc, 1900)

In Carbon Bisulphide (A.).

t°.	Gms. $HgCl_2$ per 100 Gms. Solution.
−10	0.010
0	0.018
10	0.026
15	0.032
20	0.042
25	0.053
30	0.063

In Benzene (von L.).

t°.	Gms. $HgCl_2$ per 100 Gms. Solution.
15	0.537
41	0.616
55	0.843
84	1.769

In Several Solvents at 18–20° (S.).

Solvent.	Gms. $HgCl_2$ per 100 Gms. Solvent.
$CHBr_3$	0.486
$CHCl_3$	0.106
CCl_4	0.002
C_2H_5Br	2.010
$C_2H_4Br_2$	1.530

SOLUBILITY OF MERCURIC CHLORIDE IN MIXTURES OF ACETONE AND BENZENE, ETHER AND CHLOROFORM AND OF ETHYL ACETATE AND BENZENE AT 25°.

(Marden and Dover, 1917.)

In Mixtures of $CH_3COCH_3 + C_6H_6$.		In Mixtures of $(C_2H_5)_2O + CHCl_3$.		In Mixtures of $CH_3COOC_2H_5 + C_6H_6$.	
Gms. CH_3COCH_3 per 100 Gms. Mixture.	Gms $HgCl_2$ per 100 Gms. Mixed Solvent.	Gms $CHCl_3$ per 100 Gms. Mixture.	Gms $HgCl_2$ per 100 Gms. Mixed Solvent.	Gms. $CH_3COOC_2H_5$ per 100 Gms. Mixture.	Gms. $HgCl_2$ per 100 Gms. Mixed Solvent.
100	140	0	6.95	100	49.3
90	117	10	5.85	90	26
80	96.5	20	4.73	80	22.1
70	77	30	3.70	70	18.1
60	60	40	2.80	60	14.2
50	45	50	2.10	50	11
40	31.4	60	1.48	40	8
30	20	70	0.95	30	5.4
20	10.7	80	0.657	20	3.1
10	3.9	90	0.328	10	1.6
0	0.66	100	0.128	0	0.66

SOLUBILITY OF MERCURIC CHLORIDE IN BENZENE.

(Average curve from results of Linebarger, 1895; Sherrill, 1903; and Marden and Dover, 1917.)

t°.	Gms $HgCl_2$ per 100 Gms. C_6H_6.	t°.	Gms. $HgCl_2$ per 100 Gms. C_6H_6.
0	0.20	25	0.64
10	0.39	30	0.71
20	0.56	40	0.84

SOLUBILITY OF MERCURIC CHLORIDE IN ABSOLUTE ETHYL ETHER.

(Etard, 1894; Laszcynski, 1894; Kohler, 1879.)

t°.	Gms $HgCl_2$ per 100 Gms Solution.	t°.	Gms $HgCl_2$ per 100 Gms. Solution.	t°.	Gms. $HgCl_2$ per 100 Gms. Solution.
−20	6	60	6	90	7.5
0	6	70	6.4	100	8
20	6	80	7	110	8.5

SOLUBILITY OF MERCURIC CHLORIDE IN CHLORINATED HYDROCARBONS AT 25°.

(Hoffmann, Kirmreuther and Thal, 1910.)

Solvent.	Formula.	Gms. $HgCl_2$ per 100 Gms. Solvent.	Solvent.	Formula.	Gms. $HgCl_2$ per 100 Gms. Solvent.
Ethylene Chloride	$CH_2Cl.CH_2Cl$	1 229	Dichlorethylene	$CHCl.CHCl$	0.114
Tetrachlorethane	$C_2H_2Cl_4$	0.090	Trichlorethylene	$CHCl.CCl_2$	0.0274
Chloroform	$CHCl_3$	0.101	Tetrachlorethylene	$CCl_2.CCl_2$	0.0072
Pentachlorethane	C_2HCl_5	0.0193	Carbontetrachloride	CCl_4	trace

100 gms. 95% formic acid dissolve 2.1 gm. $HgCl_2$ at 19°. (Aschan, 1913.)
100 gms. 95% formic acid dissolve 0.02 gm. Hg_2Cl_2 at 16.5°. "
100 cc. anhydrous hydrazine dissolve 1 gm. $HgCl_2$ with decomp. at room temp. (Welsh and Broderson, 1915.)
100 cc. anhydrous hydrazine dissolve 1 gm. Hg_2Cl_2 with decomp. at room temp. (Welsh and Broderson, 1915.)
100 gms. glycerol dissolve 80 gms. $HgCl_2$ at 25°. (Moles and Marquina, 1914.)
100 gms. glycerol dissolve 8 gms. $HgCl_2$? Hg_2Cl_2 at 15–16°. (Ossendowski, 1907.)
100 gms. anhydrous lanolin (m. pt. about 46°) dissolve 1.55 gms. $HgCl_2$ at 45°. (Klose, 1907.)

Solubility of Mercuric Chloride in Pyridine.

(McBride, 1910)

The determinations at the lower temperatures were made by stirring an excess of $HgCl_2$ with pyridine and analyzing the sat. solution. Those at the higher temperatures were made by the synthetic method.

t°.	Gms. $HgCl_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms $HgCl_2$ per 100 Gms. Sat. Sol.	Solid Phase.
−32.6	2.76	$HgCl_2.2C_5H_5N$	94.7	60.72	$HgCl_2.2C_5H_5N+3HgCl_2.2C_5H_5N$
−21.75	7.86	"	74.7	48.38	$HgCl_2.C_5H_5N$ (unstable)
0.02	13.14	"	83.5	50.53	" (stable)
12.58	17.34	"	90.4	53.41	" "
18.78	19.78	"	97	56.45	" "
27.23	22.65	"	100.5	57.84	" "
31.05	24.46	"	104.2	60.72	" "
40.90	29.29	"	107	63.06	" (unstable)
50.10	34.94	"	106.2	...	" $+3HgCl_2.2C_5H_5N$
60.03	40.36	"	95.2	60.77	$3HgCl_2.2C_5H_5N$ (unstable)
70.15	46.44	"	106.4	61.93	" (stable)
76	...	" $+HgCl_2.C_5H_5N$	109.8	62.58	" "
80.02	51.52	$HgCl_2.2C_5H_5N$ (unstable)	114	63.18	" "
89	56.45	" "	124.2	65	" "
94.1	60.09	" "	145.5	69.66	" "

Data for this system are also given by Staronka (1910).

Data for the solubility of $HgCl_2.2C_5H_5N$ and of $Hg(NO_3)_2.2C_5H_5N.2H_2O$ in aqueous solution of pyridine at 18°.1 are given by Stromholm (1908).

Data for the solubility of diamine mercuric chloride, $(NH_3)_2HgCl_2 - NH_2HgCl$, in aqueous solutions of ammonia at 17.5° are given by Strömholm (1908).

Solubility of Mercuric Chloride and of Double Mercuric and Tetra Methyl Amine Chloride $(CH_3)_4NCl.6HgCl_2$ in Aq. Ether at 17°.

(Stromholm — J. pr. Ch. [2] 66, 443, '02, Z. physik Chem. 44, 64, '03)

Molecular Concentration per Liter.			Grams per Liter of Solution.		
H_2O.	$HgCl_2$ (*).	$HgCl_2$ (†).	H_2O.	$HgCl_2$ (*).	$HgCl_2$ (†).
0.0	0.1515	0.0342	0	41.16	9.26
0.0656	0.1795	0.0428	1.18	48.64	11.60
0.1311	0.2069	0.0516	2.36	56.08	14.00
0.1956	0.2339	0.0603	3.52	63.38	16.34
0.2611	0.2489	0.0690	4.70	70.16	18.70
0.3267	0.2849	0.0779	5.88	77.20	21.10
0.3922	0.3100	0.0866	7.06	84.02	23.48

(*) Results in this column are for solutions in contact with the Solid Phase $HgCl_2$. (†) Results in this column are for solutions in contact with the Solid Phase $(CH_3)_4NCl.6HgCl_2$.

Solubility of Mercuric Chloride and of Double Mercuric and Tetra Methyl Amine Chloride in Alcohol-Ether Solutions at 17°.

(Stromholm.)

Grams C_2H_5OH per Liter.	Grams $HgCl_2$ (*) per Liter.	Grams $HgCl_2$ (†) per Liter.
0.0	41.16	9.26
4.58	50.00	11.87
9.16	58.76	14.38
13.74	66.96	16.90

SOLUBILITY OF DOUBLE MERCURIC CHLORIDES IN AQUEOUS AND PURE ETHER AT 16.6°.

(Strömholm, 1902, 1903.)

Mol. Conc. of $HgCl_2$ per Liter of:				Gms. $HgCl_2$ per Liter of:				Solid Phase.
Pure Ether.	Aq. Ether (1).	Aq. Ether (2).	Aq. Ether (3).	Pure Ether.	Aq. Ether (4).	Aq. Ether (5).	Aq. Ether (6).	
0.1515	0.2387	0 2647	0.3196	41.04	64.69	71.71	86.58	$HgCl_2$
0.0673	0.1157	0.1293	0.1617	18.23	31 41	35 05	43 79	$(CH_3.CH_3C_2H_4)_2SCl.6HgCl_2$
0.0404	0.0720	0.0835	0.1034	10 95	19.51	22 61	28.01	$(CH_3.C_2H_5CH_3C_2H_4)_2SCl.6HgCl_2$
0.0342	...	0.0706	...	9.26	...	19 10	...	$(CH_3)_4NCl\ 6HgCl_2$
0.0264	...	0.0568	...	7.14	..	15 39	...	$(C_2H_5)_3SCl.6HgCl_2$
0.0209	0.0400	0.0460	0.0594	5 66	10.83	12 48	16.10	$(CH_3\ C_2H_5)_2SCl.6HgCl_2$
0.0063	...	0 0144	...	1.70	...	3 90	...	$(CH_3)_2\ H_2NCl.2HgCl_2$

(1) containing 0.21055 mol H_2O per liter. (2) 0.2756 mol H_2O per liter. (3) 0 421 mol. H_2O per liter. (4) containing 3.79 gms. H_2O per liter. (5) 4 97 gms. H_2O per liter. (6) 7.59 gms. H_2O per liter.

SOLUBILITY OF MIXTURES OF MERCURIC AND POTASSIUM CHLORIDES AT 25° IN:

Abcolute Alcohol. (Foote, 1910)

Gms. per 100 Gms. Sat. Solution.		Solid Phase.
KCl.	$HgCl_2$.	
0.21	33.69	$HgCl_2+5KCl\ 6HgCl_2\ 2C_2H_5OH$
0.28	33.80	" "
0.22	24 84	$5KCl\ 6HgCl_2\ 2C_2H_5OH$
0.28	6.21	"
0.25	1 65	$5KCl.6HgCl_2.2C_2H_5OH+KCl$
0.17	1.57	" "
0.38	1.03	" "

Acetone. (Foote, 1910)

Gms. per 100 Gms. Sat Solution.		Solid Phase.
KCl.	$HgCl_2$.	
1 27	61.87	$HgCl_2+KCl.5HgCl_2.(CH_3)_2CO$
1 39	60 68	$KCl.5HgCl_2.(CH_3)_2CO$
2 58	55 85	"
2.78	54 41	" +5.6.2 .
2.93	48.13	5.6.2
2 52	18 04	"
3 34	13 26	"
2 92	11	" +KCl

5.6.2 = $5KCl.6HgCl_2.2(CH_3)_2CO$.

100 gms. of sat. abs. alcohol solution of $HgCl_2$ + NaCl contain 46.85 gms. $HgCl_2$ and 3.01 gms. NaCl at 25°. (Foote, 1910.)

SOLUBILITY OF MERCURIC CHLORIDE AND SODIUM CHLORIDE IN ETHYL ACETATE AT 40°.

(Linebarger — Am. Ch. J. 16, 214, '94.)

Mols. per 100 Mols. Acetate.		Gms. per 100 Gms. Acetate.		Gms. per 100 Gms. Solution.		Solid Phase.
NaCl.	$HgCl_2$.	NaCl.	$HgCl_2$.	NaCl.	$HgCl_2$.	
0.8	12.9	0.53	39.7	0.53	28.4	$HgCl_2$
2.3	12.4	1.53	38.15	1.51	27.61	"
4.3	16.4	2.85	50.44	2.78	33.54	"
9.1	22.85	6.05	86.14	5.60	46.28	"
18.5	34.9	12.29	107.4	10.95	51.76	"
20.0	40.0	13.29	123.0	11.73	55.18	$HgCl_2$+NaCl

The double salt $(HgCl_2)_2.NaCl$ is formed under proper conditions.

DISTRIBUTION OF MERCURIC CHLORIDE BETWEEN WATER AND BENZENE.

(Linhart, 1915.)

Results at 25°.			Results at 40°.		
Mols. $HgCl_2$ per Liter:		Conc. in H_2O / Conc. in C_6H_6	Mols. $HgCl_2$ per Liter:		Conc. in H_2O / Conc. in C_6H_6
C_6H_6 Layer.	H_2O Layer.		C_6H_6 Layer.	H_2O Layer.	
0.02100	0.2866	13.65	0.02647	0.34600	13.07
0.01224	0.15777	12.91	0.015296	0.18470	12.08
0.005244	0.064756	12.35	0.011774	0.138228	11.74
0.000618	0.007382	11.95	0.008041	0.091959	11.44
0.000310	0.003696	11.90	0.004140	0.04586	11.08
0.000155	0.001845	11.90	0.000847	0.009153	10.81

DISTRIBUTION OF MERCURIC CHLORIDE BETWEEN WATER AND ETHER.

(Hantzsch and Sebalt, 1899.)

50 cc. ether + 50 cc. sat. aqueous $HgCl_2$ solution were shaken together at different temperatures and after equilibrium was established the $HgCl_2$ in each layer determined.

t°.	Mols. $HgCl_2$ per Liter: H_2O Layer (c').	$(C_2H_5)_2O$ Layer (c^2).	$\frac{c'}{c^2}$.
0	0.0056	0.01407	0.391
10	0.0066	0.01415	0.467
17.5	0.0090	0.02150	0.419
25	0.0095	0.02076	0.429

Determinations by Skinner (1892) at room temp. using concentrations of $HgCl_2$ in the aqueous layer varying from 1.4 to 5.9 per cent, gave a distribution coefficient, $\frac{c_1}{c_2}$ = approximately 0.23.

DISTRIBUTION OF MERCURIC CHLORIDE BETWEEN AQUEOUS HCl AND ETHER AT 18°. (Mylius, 1911.)

When 1 gm. of Hg as $HgCl_2$ is dissolved in 100 cc. of H_2O or aqueous HCl and shaken with 100 cc. of ether, the percentage of the Hg which goes into the ethereal layer is as follows:

Percentage Conc. of Aq. HCl	0 (=H_2O)	1	10	20
Per cent Hg in Ether Layer	69.4	13	0.4	0.2

DISTRIBUTION OF MERCURIC CHLORIDE BETWEEN WATER AND TOLUENE AT 24°.

(Brown, 1898.)

Gms. $HgCl_2$ per 100 cc. H_2O Layer.	$C_6H_5CH_3$ Layer.	Gms. $HgCl_2$ per 100 cc. H_2O Layer.	$C_6H_5CH_3$ Layer.
0.442	0.0270	1.816	0.130
0.732	0.0488	3.766	0.292
0.780	0.0542	3.754	0.298
1.192	0.0812	6.688*	0.528*

* This solution saturated.

Results at Dif. Temperatures. (Hantzsch and Vagt, 1901.)

Results at 25°. (Morse, 1902, Drucker, 1912; Hantzsch and Vagt, 1901.)

t°.	Mols $HgCl_2$ per Liter: H_2O Layer (c_1).	$C_6H_5CH_3$ Layer (c_2).	$\frac{c_1}{c_2}$	Mols. $HgCl_2$ per Liter. H_2O Layer (c_1).	$C_6H_5CH_3$ Layer (c_2).	$\frac{c_1}{c_2}$.
0	0.0578	0.0047	12.35	0.18410	0.01590	11.6
10	0.0575	0.0050	11.60	0.09193	0.00807	11.4
20	0.0576	0.0050	11.40	0.04593	0.00410	11.1
30	0.0574	0.0051	11.20	0.02289	0.00211	10.8
50	0.0573	0.0052	11.25	0.01142	0.00108	10.5
				0.00573	0.00057	10

Data for the effect of $Hg(NO_3)_2$ upon the distribution are given by Morse (1902). Results for the effect of $ZnCl_2$ are given by Drucker (1912).

FREEZING-POINT DATA (Solubilities, see footnote, p. 1) ARE GIVEN FOR THE FOLLOWING MIXTURES:

Mercuric Chloride + Mercuric Iodide	(Padoa and Tibaldi, 1903.)
" " + Selenium	(Olivari, 1909.)
" " + Sulfur	"
" " + Nitrobenzene	(Mascarelli, 1906)
" " + *o m* and *p* Nitrotoluene	(Mascarelli, 1906, 1907, 1909.)
" " + Urethan	(" 1908, 1909.)
" " + " + α Nitronaphthalene	(" 1906, 1907.)
" " + " + *p* Nitrotoluene	(" 1908.)
" " + α Nitronaphthalene	(" 1906, 1907.)
" " + *p* Nitranisole	(" 1906.)

MERCURY CINNAMATE (ic) $(C_6H_5CH.CHCOO)_2Hg.?H_2O$.

100 gms. H_2O dissolve about 0.03 gm. mercuric cinnamate at 25°. (De Jong, 1906.)
100 gms. H_2O dissolve about 0.53 gm. Hg cinnamate at 100°. (Tarugi & Checchi, 1901.)

MERCURIC CYANIDE $Hg(CN)_2$.

SOLUBILITY IN WATER.

t°.	Gms $Hg(CN)_2$ per 100: Gms. H_2O.	cc. Sat. Sol.	Authority.
− 0.45 Eutec.	about 11	...	(Guthrie, 1878.)
13.5	9.3	...	(Timofeiew, 1894.)
15	12.5	...	(Marsh and Struthers, 1905.)
20	...	9.3	(Konowalow, 1898, 1899.)
25	...	11.12	(Sherrill, 1903.)
25	11.27	10.95 ($d_{25/4}$=1.0813)	(Herz and Anders, 1907.)
101.1	53.85	...	(Griffiths.)

One liter 5.2% aqueous NH_3 solution dissolves 204.3 gms. $Hg(CN)_2$ at about 20°. (Konowalow, 1898.)

SOLUBILITY OF MERCURIC CYANIDE IN AQUEOUS POTASSIUM CYANIDE SOLUTIONS AT 25°. (Sherrill, 1903.)

Mols per Liter. KCN.	$Hg(CN)_2$.	Gms per Liter. KCN.	$Hg(CN)_2$.
0.0493	0.4855	3.21	122.6
0.0985	0.5350	6.41	135.2
0.1970	0.6270	12.83	158.4

The regularity of the increase in solubility proves that the complex $Hg(CN)_2$. KCN is formed at the given concentrations.

Data are also given for the distribution of $Hg(CN)_2$ between aqueous solutions of KCN and ether at 25°.

SOLUBILITY OF MERCURIC CYANIDE IN AQUEOUS SOLUTIONS OF METHYL ALCOHOL, ETHYL ALCOHOL AND OF ETHYL ACETATE AT 25°. (Herz and Anders, 1907.)

In Aq. Methyl Alcohol. Wt. % CH_3OH in Solvent.	$d_{25/4}$ of Sat. Sol.	Gms $Hg(CN)_2$ per 100 cc. Sat. Sol.	In Aq. Ethyl Alcohol. Wt % C_2H_5OH in Solvent.	$d_{25/4}$ of Sat. Sol.	Gms. $Hg(CN)_2$ per 100 cc. Sat Sol.	In Aq. Ethyl Acetate. Wt. % $CH_3COOC_2H_5$ in Solvent.	$d_{25/4}$ of Sat. Sol.	Gms. $Hg(CN)_2$ per 100 cc. Sat. Sol.
10.6	1.0640	11.02	0	1.0813	10.95	0	1.0810	10.95
30.77	1.0484	12.46	20.18	1.0339	8.76	4.39	1.0798	10.83
47.06	1.0426	16.37	40.69	1.0006	9.02	96.76	1.9374	2.66
64	1.0441	20.48	70.01	0.9419	9.57	100	0.9097	1.80
78.05	1.0484	24.58	100	0.8552	8.19			
100	1.0762	34.29						

SOLUBILITY OF MERCURIC CYANIDE IN ETHYL ALCOHOL, METHYL ALCOHOL AND IN MIXTURES OF THE TWO.

In Ethyl Alcohol. (Timofeiew, '94; de Bruyn, '92; Herz and Kuhn, 1908.) t°.	Gms. $Hg(CN)_2$ per 100 Gms. Sat Sol.	In Methyl Alcohol. (Dukelski, 1907.) t°.	Gms. $Hg(CN)_2$ per 100 Gms. Sat Sol.	In $CH_3OH+C_2H_5OH$ at 25°. (Herz and Kuhn, 1908.) % CH_3OH in Mixture.	$d_{25/4}$ of Sat. Sol.	Gms. $Hg(CN)_2$ per 100 cc. Sat. Sol.
0	8.3	0	26.10	4.37	0.8618	9.02
10	8.8	14.17	29.17	10.4	0.8707	10.10
20	9.25	23.4	32.01	41.02	0.9267	16.70
25	9.53*	27.4	31.77	80.69	1.024	28.20
30	9.8	31.7	32.53	84.77	1.034	29.60
40	10.3	38.1	33.29	91.25	1.052	30
* $d_{25/4}$=0.8552		44.5	34.05	100	1.076	34.30

100 gms. of a sat. solution of $Hg(CN)_2$ in a mixture of equimolecular amounts of CH_3OH and C_6H_6 contain 10.2 gms. $Hg(CN)_2$ at 10°, 13 gms. at 30° and 15 gms. at 50°. (Dukelski, 1907.)

SOLUBILITY OF MERCURIC CYANIDE IN MIXTURES OF PROPYL AND METHYL ALCOHOLS AND PROPYL AND ETHYL ALCOHOLS AT 25°. (Herz and Kuhn, 1908.)

In $C_3H_7OH+CH_3OH$.				In $C_3H_7OH+C_2H_5OH$.			
% C_3H_7OH in Mixed Solvent.	d_{25} of Solvent.	d_{25} of Sat. Sol.	Gms. $Hg(CN)_2$ per 100 cc. Sat. Sol.	% C_3H_7OH in Mixed Solvent.	d_{25} of Solvent.	d_{25} of Sat. Sol.	Gms. $Hg(CN)_2$ per 100 cc. Sat. Sol.
0	0.7878	1.0760	34.3	0	0.7867	0.8552	8.91
11.11	0.7894	1.0327	29.52	8.1	0.7886	0.8549	7.90
23.80	0.7907	0.9891	24.48	17.85	0.7902	0.8527	7.30
65.20	0.7954	0.8800	10.48	56 6	0.7926	0 8386	5.21
91.80	0.7992	0.8376	5.04	88 6	0.7973	0.8311	3.87
93.75	0.7995	0.8335	4.23	91.2	0.7979	0.8306	3.84
96.60	0.7999	0.8322	3.98	95.2	0 7986	0.8293	3.64
100	0.8004	0.8283	3.44	100	0 8004	0.8283	3.44

100 gms. propyl alcohol dissolve 3.79 gms. $Hg(CN)_2$ at 13.5°. (Timofeiew, 1894.)
100 gms. acetonitrile (b. pt. 81.6°) dissolve 9.58 gms. $Hg(CN)_2$ at 18°. (Naumann and Schier, 1914.)
100 gms. benzonitrile (b. pt. 190–1°) dissolve 1.093 gms. $Hg(CN)_2$ at 18°. (Naumann, 1914.)

SOLUBILITY OF MERCURIC CYANIDE IN ANILINE. (Staronka, 1910)

t° of Solidification	41°	49	58.5	65	77	83.5	84	88.5
Mol. % $Hg(CN)_2$ in sat. Solution	3.7	5.7	7.7	9	14.2	18.2	19 7	23.4

The solid phases are the unstable $Hg(CN)_2.4C_6H_5NH_2$ and the stable $Hg(CN)_2.2C_6H_5NH_2$ (m. pt. about 90°).

One liter sat. solution in ethyl ether contains 2.53 gms. $Hg(CN)_2$ at 25°. (Abegg and Sherrill, 1903)

100 gms. glycerol dissolve 27 gms. $Hg(CN)_2$ at 15.5°.

SOLUBILITIES OF MERCURIC CYANIDE DOUBLE SALTS IN WATER AND IN ALCOHOL.

Double Salt.	t°.	Gms. per 100 Grams. Water.	Alcohol.	Observer.
$Hg(CN)_2.2KCN$	cold	22.7	...	
$Hg(CN)_2.2TlCN$	1°	12.6	...	(Fromuller — Ber. 11, 92, '78.)
$Hg(CN)_2.2TlCN$	10°	9.7	...	" "
$2Hg(CN)_2.CaBr_2.5H_2O$	cold	100.0	50.0	(Custer)
$2Hg(CN)_2.CaBr_2.5H_2O$	boiling	400.0	100.0	"
$Hg(CN)_2.KCl.H_2O$	18°	14.81	...	(Brett.)
$Hg(CN)_2.KBr.2H_2O$	18°	7.49	...	"
$Hg(CN)_2.KBr.2H_2O$	boiling	100.0+	...	"
$Hg(CN)_2.BaI_2.4H_2O$	cold	6.42	4.42	(Custer.)
$Hg(CN)_2.BaI_2.4H_2O$	boiling	250.0	62.5 (90% Alc.)	"
$Hg(CN)_2.KI$	cold	6.2	1.04 (34° B Alc.)	(Caillot.)
$Hg(CN)_2.NaI.2H_2O$	18°	22.2	15.4 (90% Alc.)	(Custer.)
$Hg(CN)_2.SrI_2.6H_2O$	18°	14.3	25.0 (90% Alc.)	"

SOLUBILITY OF MECURIC CYANIDE IN ORGANIC SOLVENTS AT 18°–20°. (Sulc, 1900)

Solvent.	Formula.	G. $Hg(CN)_2$ per 100 Gms. Solvent.
Bromoform	$CHBr_3$	0.005
Carbon Tetra Chloride	CCl_4	0.001
Ethyl Bromide	C_2H_5Br	0.013
Ethylene Di Bromide	$C_2H_4Br_2$	0.001

Data for the ternary system, mercuric cyanide, phenol, water are given by Timmermans, 1907.

SOLUBILITY OF MERCURIC CYANIDE IN PYRIDINE. (Staronka, 1910.)

t°.	Mols. $Hg(CN)_2$ per 100 Mols. $Hg(CN)_2+C_5H_5N$	Solid Phase.	t°.	Mols. $Hg(CN)_2$ per 100 Mols. $Hg(CN)_2+C_5H_5N$	Solid Phase.	t°.	Mols. $Hg(CN)_2$ per 100 Mols. $Hg(CN)_2+C_5H_5N$	Solid Phase.
9	7.1	$Hg(CN)_2.6C_5H_5N$	22.5	17.3	$Hg(CN)_2.2C_5H_5N$	56.5	26.6	$2Hg(CN)_2.3C_5H_5N$
11	8.7	"	28.5	18.4	"	68	27.5	$Hg(CN)_2.C_5H_5N$
12.2	10.4	"	32	19.3	"	70	27.7	"
13	11.3	"	38	20.6	"	86	29	"
13.5	12.9	"	42	22.3	"	111	32	"
14.5	13.8	"	46	23.7	"	122.5	33.8	"
16.5	15.8	"	53	25.3	$2Hg(CN)_2.3C_5H_5N$	125	34.4	"
20.5	15.9	"	54.5	26	"	141	38.3	"

100 gms. pyridine dissolve 64.8 gms. $Hg(CN)_2$ at 18°. (Schroeder, 1905.)

SOLUBILITY OF MERCURIC CYANIDE IN QUINOLINE. (Staronka, 1910.)

t°.	Mols. $Hg(CN)_2$ per 100 Mols. $Hg(CN)_2+C_9H_7N$.	Solid Phase.	t°.	Mols $Hg(CN)_2$ per 100 Mols. $Hg(CN)_2+C_9H_7N$.	Solid Phase.
45	4.2	$Hg(CN)_2.3C_9H_7N$	137	13.2	$Hg(CN)_2.2C_9H_7N$(?)
54	6	" tr. pt. 60°	161	17.4	"
89 (61°)	8.2		180	22.5	"
99 (61)	9.2		192	27.1	"

MERCURY FULMINATE $C_2HgN_2O_2$.

One liter of solution in water contains 0.70 gm. $C_2HgN_2O_2$ at 12° and 1.76 gms. at 49°. (Holleman, 1896.)

MERCURIC IODIDE HgI_2.

SOLUBILITY IN WATER.

t°.	Gms. HgI_2 per Liter.	Observer.
18	0.0004 (conductivity method)	(Kohlrausch, 1904-05.)
17.5	0.040	(Bourgoin, 1884.)
22	0.054	(Rohland, 1898.)
25	0.0591	(Morse, 1902.)

SOLUBILITY OF MERCUROUS IODIDE IN WATER AT 25°. (Sherrill, 1903.)

One liter sat. solution contains 2×10^{-7} gms. Hg_2I_2, determined by indirect method.

Data for the solubility of mercurous iodide in aq. KI solutions at 25° are also given by Sherrill.

SOLUBILITY OF MERCURIC IODIDE IN AQUEOUS SOLUTIONS AT 25°. (Herz and Paul, 1913.)

In Aq. BaI_2. Mols. per Liter. BaI_2.	HgI_2.	In Aq. CaI_2. Mols. per Liter. CaI_2	HgI_2.	In Aq. NaI. Mols per Liter. NaI.	HgI_2.	In Aq. SrI_2. Mols per Liter. SrI_2.	HgI_2.
0.099	0.059	0.053	0.050	0.794	0.412	0.254	0.212
0.748	0.742	0.252	0.261	1.385	0.622	0.355	0.320
0.978	0.897	0.468	0.440	2.225	0.945	0.539	0.582
1.508	1.462	1.799	1.706			0.608	0.694

SOLUBILITY OF MERCURIC IODIDE IN AQUEOUS SOLUTIONS OF POTASSIUM IODIDE AT 25°. (Sherrill, 1903; Herz and Paul, 1913.)

Mols. per Liter. KI.	HgI_2.	Gms. per Liter. KI.	HgI_2.	Mols. per Liter. KI.	HgI_2.	Gms. per Liter. KI.	HgI_2.
0.05	0.025	8.3	11.4	1	0.50	166	227.2
0.10	0.05	16.6	22.7	1.5	0.75	249	340.8
0.20	0.10	33.2	45.4	2	1	332	454.5
0.50	0.25	83	113.6	2.5	1.25	415	578

Data for the distribution of mercuric iodide between aq. KI solutions and benzene at 25° are given by Sherrill, 1903.

EQUILIBRIUM IN THE TERNARY SYSTEM MERCURIC IODIDE, POTASSIUM IODIDE, WATER AT 20° AND 30°. (Dunningham 1914.)

Results at 20°. Gms. per 100 Gms. Sat Sol. KI.	HgI_2.	Solid Phase.	Results at 30°. Gms. per 100 Gms Sat Sol KI	HgI_2.	Solid Phase.
50.9	19.3	KI	60.6	...	KI
44.4	32.4	"	40	53	" $+KHgI_3$
39	48	"	39.6	52.7	$KHgI_3$
37.4	53.6	" $+KHgI_3$	40	52.2	"
37.8	52.6	$KHgI_3$	40.2	51.2	"
35.1	52.2	"	39.3	50.3	"
35.5	51 2	$KHgI_3.H_2O$	33.7	49.8	"
26.7	50.3	" $+HgI_2$	33	52	"
26.6	49.4	HgI_2	31.4	51.7	$KHgI_3.H_2O$
23.7	40.2	"	29.1	52.2	"
14.9	22.5	"			

EQUILIBRIUM IN THE TERNARY SYSTEM MERCURIC IODIDE, POTASSIUM IODIDE, ETHYL ETHER AT 20°. (Dunningham, 1914)

Two liquid layers with compositions as follows, are formed:

Gms. per 100 Gms Upper Layer. KI.	HgI_2	Gms per 100 Gms Lower Layer KI.	HgI_2	Solid Phase.
1.1	2.8	None		$KI+KHgI_3$
1.1	2.4	17.6	53.2	$KHgI_3$
0.8	2.5	16.5	56 1	HgI_2
None		17	58.2	$KHgI_3+HgI_2$

Data are also given for the four component system, $HgI_2 + KI + (C_2H_5)_2O + H_2O$ at 20°. The results are of special interest since 3 liquid layers are formed.

SOLUBILITY OF MERCURIC IODIDE IN AQUEOUS ETHYL ALCOHOL:

At 18°. (Bourgoin.)

Solvent.	Gms HgI_2 per Liter.
Abs. Alcohol	11.86
H_2O+80% 90° Alc.	2 857
H_2O+10% 90° Alc.	0.086

At 25°. (Herz and Knoch — Z. anorg. Ch. 45, 266, '05.)

Wt.% Alcohol in Solvent.	HgI_2 per 100 cc. Solution. Millimols.	Grams	Sp Gr. of Solutions 25°/4°
100	3.86	1.754	0.8033
95.82	2.56	1.162	0.8095
92.44	1.92	0.873	0.8154
86.74	1.38	0.623	0.8300
78 75	0.935	0.425	0.8465
67.63	0.45	0.204	0.8721

SOLUBILITY OF MERCURIC IODIDE IN AQUEOUS METHYL ALCOHOL AND IN AQUEOUS ETHYL ACETATE AT 25°. (Herz and Anders, 1907.)

In Aq. Methyl Alcohol. Wt. % CH_3OH in Solvent.	$d_{\frac{25}{4}}$ of Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol	Gms HgI_2 per 100 cc. Sat Sol	In Aq. Ethyl Acetate. Wt. % $CH_3COOC_2H_5$ in Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. HgI_2 per 100 cc. Sat. Sol
47.06	0.9186	0.9187	0.044	4.36	0.9973	0.013
64	0.8800	0.8834	0.158	96.74	0.9063	1.87
78.05	0.8489	0.8519	0.445	100	0.9011	1.09
100	0.7879	0.8155	2.590			

100 gms. sat. solution in 95% alcohol (d_{15} = 0.8126) contain 0.72 gm. HgI_2 at 0°, 1.06 gms. at 25° and 2.15 gms. at 50°. (Reinders, 1900.)

SOLUBILITY OF MERCURIC IODIDE IN ALCOHOLS.

Alcohol.	Formula.	t°.	Sp. Gr. of Solution.	Gms. HgI_2 per 100 Gms. Alcohol.	Observer.
Methyl	CH_3OH	15–20	0.799	3.24	(Rohland.)
"	"	19	...	3.7	(Timofeiew.)
"	"	19.5	...	3.16	(de Bruyn.)
"	"	23	...	3.98	(Beckmann.)
"	"	66 (b. pt.)	...	6.512	(Sulc.)
Ethyl	C_2H_5OH	15–20	0.810	1.42	(Rohland.)
"	"	18	...	1.48	(Bourgoin.)
"	"	19	...	1.86	(Timofeiew.)
"	"	19.5	....	2.09	(de Bruyn.)
"	"	25	0.803	2.19	(Herz and Knoch.)
"	"	78 (b. pt.)	...	4.325	(Sulc.)
Propyl	C_3H_7OH	15–20	0.816	0.826	(Rohland.)
"	"	19	...	1.25	(Timofeiew.)
Amyl	$C_5H_{11}OH$	13	...	0.66	(Laszcynski.)
"	"	71	...	3.66	"
"	"	100	...	5.30	"
"	"	133.5	...	9.57	"
Isopropyl	$(CH_3)_2CH.OH$	81 (b. pt.)	...	2.266	(Sulc.)
Isobutyl	$(CH_3)_2CHCH_2OH$	22.5	...	0.51	(Timofeiew.)
"	"	105–107 (b. pt.)	...	2.433	(Sulc.)

SOLUBILITY OF MERCURIC IODIDE IN MIXTURES OF ALCOHOLS AT 25°.

(Herz and Kuhn, 1908)

In $CH_3OH+C_2H_5OH$.			In $C_3H_7OH+CH_3OH$.			In $C_3H_7OH+C_2H_5OH$.		
Per cent CH_3OH in Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms HgI_2 per 100 cc. Sat. Sol.	Per cent C_3H_7OH in Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. HgI_2 per 100 cc. Sat. Sol.	Per cent C_3H_7OH in Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms HgI_2 per 100 cc. Sat. Sol.
0	0.8038	1.80	0	0.8156	3.16	0	0.8038	1.80
4.37	0.8039	1.93	11.11	...	...	8.1	0.8036	1.73
10.40	0.8046	2.08	23.80	0.8155	3.04	17.85	0.8043	1.65
41.02	0.8077	2.32	65.20	...	...	56.6	0.8057	1.55
80.69	0.8131	2.89	91.80	0.8101	1.69	88.6	...	...
84.77	0.8140	2.96	93.75	0.8110	1.67	91.2	0.8099	1.52
91.25	0.8146	2.98	96.60	0.8108	1.53	95.2	0.8108	1.44
100	0.8156	3.16	100	0.8116	1.42	100	0.8116	1.42

SOLUBILITY OF MERCURIC IODIDE IN ACETONE IN ETHYL ACETATE AND IN BENZENE.

(Sulc; Krug and McElroy — J. Anal. Ch. 6, 186, '92; Laszcynski — Ber. 27, 2285, '94.)

In Acetone.		In Ethyl Acetate.		In Benzene.	
t°.	Gms. HgI_2 per 100 Gms. $(CH_3)_2CO$.	t°.	Gms. HgI_2 per 100 Gms. $CH_3COOC_2H_5$.	t°.	Gms. HgI_2 per 100 Gms. C_6H_6.
−1	2.83	−20	1.49	15	0.22
18	3.36	+17.5	1.56	60	0.88
25	2.09 (K. and McE.)	21	1.64	65	0.95
40	4.73	40	2.53	84	1.24
58	6.07	55	3.19	80 (b.pt.)	0.825 (Sulc.)
56 (b.pt.)	3.249 (Sulc.)	76	4.31		
		74–78 (b.pt.)	4.20 (Sulc.)		

100 gms. acetone	dissolve	2.04 gms.	HgI_2	at 23°.	(Beckmann and Stock, 1895.)
" benzene	"	0.25 "	"	"	" "
" chloroform	"	0.07 "	"	"	" "
" acetone	"	2 "	"	(red) at 25°.	(Reinders, 1900.)
" "	"	3.09 "	"	(yellow) at 25°.	"
" ethyl acetate	"	1.47 "	"	at 18°.	(Naumann, 1910.)

One liter sat. solution in benzene contains 2.24 gms. HgI_2 at 25°. (Abegg and Sherrill, 1903.)

SOLUBILITY OF MERCURIC IODIDE IN ANILINE.

(Pearce and Fry, 1914.)

t°.	Gms HgI_2 per 100 Gms. Aniline.	Solid Phase.	t°.	Gms. HgI_2 per 100 Gms. Aniline.	Solid Phase.
−11.48*	...	$C_6H_5NH_2+HgI_2\,2C_6H_5NH_2$	48.8	128.1	HgI_2 (red)
− 6.5	23.35	$HgI_2\,2C_6H_5NH_2$	63.6	163.8	"
+ 0.4	28.69	"	70.82	184.1	"
17.8	42.85	"	76.2	201.6	"
21.1	47.55	"	95.9	246.7	"
26.9	55.47	"	108†	...	" + HgI_2 (yellow)
30.1	62.05	"	115.7	281.8	HgI_2 (yellow)
36.2	75.80	"	137.2	285.2	"
42.9	96.49	"	181.1	297.9	"
46.8†	...	" + HgI_2 (red)	199.1	863.2	"

* Eutec. † Tr. pt.

Additional data on this system are also given by Staronka, 1910.

Data for the solubility of mercuric iodide in nitrobenzene and in *p* nitrotoluene, determined by the synthetic (sealed tube method), are given by Smits and Bakhorst (1915). The transition point of HgI_2, red to yellow, was found to be at 1.68 mol. per cent HgI_2 and 127.5° in nitrobenzene and 1.81 mol. per cent HgI_2 and 128° in *p* nitrotoluene. The interesting part of the investigation is the characteristic prolongation of the melting line above the transition point. Similar data for the solubility of mercuric iodide in nitrobenzene, *m* nitrotoluene, *p* nitrotoluene and in nitronaphthalene, determined by the freezing-point method, using a Beckmann apparatus, are given by Mascarelli (1906a). Observations on the appearance and color changes of the HgI_2 are given.

SOLUBILITY OF MERCURIC IODIDE IN CARBON DISULFIDE.

(Linebarger, 1894; Arctowski, 1894, 1895–96.)

t°.	Gms. HgI_2 per 100 Gms. Solution.	t°.	Gms. HgI_2 per 100 Gms. Solution.	t°.	Gms HgI_2 per 100 Gms. Solution.
−116	0.017	− 5	0.141	15	0.271
− 93	0.023	0	0.173	20	0.320
− 86.5	0.024	+ 5	0.207	25	0.382
− 10	0.107	10	0.239	30	0.445

One liter sat. solution of mercuric iodide in CS_2 contains 3.127 gms. at 15°. (Dawson, 1909b).

One liter sat. solution of mercuric iodide in CCl_4 contains 0.170 gm. at 18°. (Dawson, 1909b)

Data are also given by Dawson for the distribution of HgI_2 between aqueous solutions of KI and CS_2 at 15° and aqueous solutions of KI and CCl_4 at 18°.

100 cc. anhydrous hydrazine dissolve 69 gms. HgI_2 with precipitation of Hg at room temp. (Welsh and Broderson, 1915.)

SOLUBILITY OF MERCURIC IODIDE IN SEVERAL ORGANIC SOLVENTS.

(Sulc — Z. anorg. Ch. 25, 401, '00.)

Solvent.	Formula.	t°.	Gms. HgI_2 per 100 Gms. Solvent.
Chloroform	$CHCl_3$	18–20	0.040
Chloroform	$CHCl_3$	61 (b. pt.)	0.163
Bromoform	$CHBr_3$	18–20	0.486
Tetra Chlor Methane	CCl_4	18–20	0.006
Tetra Chlor Methane	CCl_4	75 (b. pt.)	0.094
Ethyl Bromide	C_2H_5Br	18–20	0.643
Ethyl Bromide	C_2H_5Br	38° (b. pt.)	0.773
Ethylene Di Bromide	$C_2H_4Br_2$	18–20	0.748
Ethyl Iodide	C_2H_5I	18–20	2.041
Ethylene Di Chloride	$C_2H_4Cl_2$	85.5° (b. pt.)	1.200
Iso Butyl Chloride	$(CH_3)_2.CHCH_2Cl$	69 "	0.328
Methyl Formate	$HCOOCH_3$	36–38 "	1.166
Ethyl Formate	$HCOOC_2H_5$	52–55 "	2.150
Methyl Acetate	CH_3COOCH_3	56–59 "	2.500
Acetal	$CH_3CH(OC_2H_5)_2$	105 "	2.000
Epi Chlor Hydrine	$CH_2.O.CH.CH_2Cl$	117 "	6.113
Hexane	C_6H_{14}	67 ...	0.072

SOLUBILITY OF MERCURIC IODIDE IN ETHER AND IN METHYLENE IODIDE.

In Ether. (Sulc; Laszcynski.) — In Methylene Iodide. (Retgers — Z. anorg. Ch. 3, 253, '93.)

t°.	Gms. HgI_2 per 100 Gms. $(C_2H_5)_2O$.	t°.	Gms. HgI_2 per 100 Gms. CH_2I_2.
0	0.62	15	2.5
36	0.97	100	16.6
35 (b. pt.)	0.47 (Sulc)	180	58.0

SOLUBILITY OF MERCURIC IODIDE IN FATTY BODIES.

(Mehu — J. pharm. chim. [5] 12, 249, '85.)

Solvent.	t°.	Gms. HgI_2 per 100 Gms. Solvent.	Solvent.	t°.	Gms. HgI_2 per 100 Gms. Solvent.
Bitter Almond Oil	25	0.5	Vaseline	25	0.025
Bitter Almond Oil	100	1.3	Vaseline	100	0.20
Castor Oil	25	4.0	Poppy Oil	25	1.0
Castor Oil	100	20.0	Olive Oil	25	0.4
Nut Oil	100	1.3	Carbolic Acid	100	2.0

100 grams oil of bitter almonds dissolve 5.0 grams $HgI_2.KI$ at 25°. (Mehu.)

SOLUBILITY OF MERCURIC IODIDE IN OILS.

(Anon, 1903, 1904.)

Oil.	Gms. HgI_2 per 100 cc. Oil.	Oil.	Gms. HgI_2 per 100 cc. Oil.
Castor Oil	1.90	Peanut Oil	0.52
Walnut "	1.29	Olive "	0.45
Linseed "	1.23	Almond "	0.39
Cod Liver "	0.545	Vaseline	0.26

SOLUBILITY OF MERCURIC IODIDE IN PYRIDINE.

(Determinations from $-50°$ to $98.5°$ made by saturating the solvent at constant temperatures are given by Mathews and Ritter (1917). Measurements of the points of solidification of various mixtures of the two components, covering the range from 10° to 135°, are given by Staronka (1910).

t°.	Gms. HgI_2 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. HgI_2 per 100 Gms. Sat. Sol.	Solid Phase.
−50	1.93	$HgI_2.2C_5H_5N$	90.08	61.43	$HgI_2.2C_5H_5N$
−31.5	4.27	"	100	65.72	"
−10	10.28	"	105	68.89	"
− 0.1	14.85	"	107 m. pt.	72.09	"
+ 8.83	18.42	"	105	75.67	"
20.02	24.40	"	100	79.73	"
25.55	27.90	"	90	84.16	"
40.08	37.64	"	87 Eutec.	85.17	" $+HgI_2.C_5H_5N$
50.02	43.15	"	100	86	$HgI_2.C_5H_5N$
60.07	48.29	"	120	87.16	"
80.05	57.60	"	135	88.78	"

SOLUBILITY OF MERCURIC IODIDE IN QUINOLINE.
(Staronka, 1910.)

t°.	Mols. HgI_2 per 100 Mols. $HgI_2+C_9H_7N$.	Solid Phase.	t°.	Mols. HgI_2 per 100 Mols. $HgI_2+C_9H_7N$.	Solid Phase.
100	4.7	$HgI_2.2C_9H_7N$	160	37.7	$HgI_2.C_9H_7N$
115.5	9.1	"	165	41.6	"
133.5	13 2	"	165	43	"
138	23.1	"	170	48.8	"
145	26.7	$HgI_2.C_9H_7N$	169.5	49.5	"
153	31.4	"	166.5	54.4	"

Fusion point data for mixtures of HgI_2 + I are given by Olivari, 1908.

MERCURIC IODIDE Diamine $(NH_3)_2HgI_2$.

Data for the solubility of diamine mercuric iodide in aqueous ammonia solutions at 20° are given by Francois (1900). The solid is not stable in solutions containing less than 48 gms. NH_3 per liter.

MERCURY NITRATE (ic) $Hg(NO_3)_2$, (ous) $Hg_2(NO_3)_2$.

100 gms. anhydrous lanolin (m. pt. about 46°) dissolve 1.15 gm. $Hg(NO_3)_2$ at 45°. (Klose, 1907.)

100 cc. anhydrous hydrazine dissolve about 2 gms. $Hg_2(NO_3)_2$ with precipitation of Hg at room temp. (Welsh and Broderson, 1915.)

MERCURY OXIDE HgO.

SOLUBILITY IN WATER.
(Schick, 1903.)

t°.	Gms per 1000 cc. Solution.	
25	0.0518 yellow HgO	0.0513 red HgO
100	0.410 yellow HgO	0.379 red HgO

At 25° the mixtures were constantly agitated for 4 days or longer. At 100° the solutions were boiled and stirred for 5 hours. A longer period would probably have caused better agreement between the red and yellow HgO.

One liter H_2O dissolves 0.05 gm. HgO (red, large grains) at 25°. (Hulett, 1901.)

One liter H_2O dissolves 0.15 gm. HgO (red, finest grains) at 25°. "

SOLUBILITY OF MERCURIC OXIDE IN AQUEOUS HYDROFLUORIC ACID AT 25°.

(Jaeger, 1901.)

Normality of HF.	Gms. Hg per 9.6 cc. Sat. Sol.	Gm. Atoms Hg per Liter.
0.12	0.0242	0.01258
0.24	0.0475	0.0247
0.57	0.1210	0.0629
1.11	0.2247	0.1168
2.17	0.4976	0.2586

MERCURY DIPHENYL $Hg(C_6H_5)_2$.

Fusion-point data for mixtures of $Hg(C_6H_5)_2 + Sn(C_6H_5)_4$ are given by Cambi (1912).

MERCURY SELENITE $HgSeO_3$.

SOLUBILITY IN AQUEOUS SODIUM SELENITE SOLUTIONS AT 25°.

(Rosenheim and Pritze, 1909.)

Normality of Na_2SeO_3 Solution.	Gms. $HgSeO_3$ per 100 Gms. Sat. Sol.	Normality Na_2SeO_3 of Solution.	Gms. $HgSeO_3$ per 100 Gms. Sat. Sol.
0.0625	0.18	0.5	0.70
0.125	0.32	1	1.39
0.25	0.53	2	2.73

MERCURY SULFATE (ic) $HgSO_4$.

EQUILIBRIUM IN THE SYSTEM, MERCURY OXIDE, SULFUR TRIOXIDE, WATER

(Hoitsema, 1895)

Results expressed in molecules per sum of 100 molecules of the three components of the system. The mixtures were rotated for 3 hours or longer.

Results at 25°.

Liquid Phase. H_2O.	SO_3.	HgO.	Solid Phase.
98.5	1.24	0.33	$3HgO.SO_3$
96.6	2.49	0.92	"
94.4	3.93	1.65	"
93.9	4.24	1.85	$3HgO.SO_3$ and $3HgO.2SO_3.2H_2O$
94.4	4.52	2.12	$3HgO.SO_3$ and $3HgO.2SO_3.2H_2O$
93.4	4.65	1.94	$3HgO.2SO_3.2H_2O$
92.9*	4.81	2.29	$3HgO.SO_3$
92.9	5.11	1.98	$3HgO.2SO_3.2H_2O$
92.3*	5.20	2.54	$3HgO.SO_3$
92.3	5.58	2.09	$3HgO.2SO_3.2H_2O$
92.1	5.81	2.08	"
91.9	5.97	2.90	$3HgO.SO_3$
91.9	6.15	2.05	$3HgO.2SO_3.2H_2O$
91.3	6.54	2.13	"
91.2	6.77	2.02	$HgO.SO_3.H_2O$
91.3	6.90	1.80	"
91.3	7.67	1.01	"
91.3	7.84	0.89	$HgO.SO_3.H_2O$ and $HgO.SO_3$
91	8.36	0.69	$HgO.SO_3.H_2O$ and $HgO.SO_3$
90.5	8.95	0.53	"
89.2	10.6	0.22	$HgO.SO_3$
75.8	24.2	trace	"
39.2	60.7	trace	"

Results at 50°.

Liquid Phase. H_2O.	SO_3.	HgO.	Solid Phase.
98.9	0.96	0.17	$3HgO.SO_3$
96	3.05	0.93	"
93.2	4.92	1.90	"
92.8	5.10	2.09	"
92.8	5.16	2.06	"
92.5	5.34	2.12	"
92.2	5.57	2.20	$3HgO.SO_3$ and $3HgO.2SO_3.2H_2O$
92.1	5.75	2.11	$3HgO.2SO_3.2H_2O$
92	5.80	2.16	"
91.2*	6.27	2.56	$3HgO.SO_3$ and $HgO.SO_3$
91.5	6.34	2.19	$3HgO.2SO_3.2H_2O$ and $HgO.SO_3$
91.3*	6.37	2.30	$HgO.SO_3$
91.6	6.69	1.75	"
91.1	8.32	0.57	"
90.5	9.11	0.4	"
89.6	10.2	0.23	"
86.7	13.2	0.06	"
31.6	68.4	0.03	"

* Indicates unstable equilibrium

MERCUROUS SULFATE Hg_2SO_4.

SOLUBILITY IN WATER, IN SULFURIC ACID AND IN POTASSIUM SULFATE AT 25°.
(Drucker, 1901; Wright and Thomson, 1884-85; Wilsmore, 1900.)

Solvent.	Hg_2SO_4 per Liter. 1 Gm. Mol.	Gms.	
Water	11.71 10^{-4}	0.58	(0.47 W. and T., 0.39 W.)
Aq. H_2SO_4 (1.96 gms. per liter)	8.31 "	0.41	
Aq. H_2SO_4 (4.90 gms. per liter)	8.78 "	0.44	
Aq. H_2SO_4 (9.80 gms. per liter)	8.04 "	0.40	
Aq. K_2SO_4 (34.87 gms. per liter)	9.05 "	0.45	

SOLUBILITY OF MERCUROUS SULFATE IN WATER AT DIFFERENT TEMPERATURES.
(Barre, 1911)

t°.	Gms per 100 Gms. Sat. Sol. Hg_2SO_4.	H_2SO_4.	Solid Phase.
16.5	0.055	0.008	Hg_2SO_4
33	0.060	0.018	"
50	0.065	0.037	"
75	0.074	0.063	"
100°	0.092	0.071	"

The mixtures were kept at constant temp. but not constantly agitated. By successive treatment of a given amount of Hg_2SO_4 with H_2O, it is gradually converted to an almost insoluble basic salt, $Hg_2O.Hg_2SO_4.H_2O$.

SOLUBILITY OF MERCUROUS SULFATE IN AQUEOUS POTASSIUM SULFATE SOLUTIONS. (Barre, 1911)

Results at 15°. Gms. per 100 Gms. Sat. Sol. K_2SO_4.	Hg_2SO_4.	H_2SO_4 (free).	Results at 33°. Gms. per 100 Gms. Sat. Sol. K_2SO_4.	Hg_2SO_4.	H_2SO_4 (free).	Results at 75°. Gms. per 100 Gms. Sat. Sol. K_2SO_4.	Hg_2SO_4.	H_2SO_4 (free)
2.90	0.0475	0.0080	2.94	0.0677	0.0250	3.10	0.1344	0.1684
5.70	0.0703	0.0093	5.68	0.1015	0.0350	5.75	0.2120	0.2135
8.22	0.0912	0.0098	8.30	0.1364	0.0441	8.50	0.2951	0.2514
8.77	0.0994	...	10.70	0.1724	0.0438	13.20	0.4610	0.2503
9.44	0.1080	0.0110	11.90	0.1902	0.0420	17.30	0.6440	0.2225

MERCURY SULFIDE HgS.

One liter H_2O dissolves 0.054×10^{-6} mols. HgS = 0.0000125 gm. at 18°.
(Weigel, 1906, 1907. See also Bruner and Zawadzki.)

Hexamethyl **MELLITIC ACID** Ester $C_6(COOCH_3)_6$.

Data for the ternary system hexamethyl mellitic acid ester, phenol and water are given by Timmermans (1907).

MENTHOL $C_{10}H_{19}OH$.

One cc. of 95% alcohol dissolves about 5 gms. menthol at room temp.
(Greenish and Smith, 1903.)

FREEZING-POINT DATA (Solubility, see footnote, p. 1) ARE GIVEN FOR THE FOLLOWING MIXTURES.

Menthol	+ Ethylene bromide	(Dahms, 1895.)
"	+ Menthane	(Vanstone, 1909.)
"	+ Methyl urethan	(Scheuer, 1910.)
"	+ Naphthalene	"
"	+ *p* Toluidine	(Pawlewski, 1893.)

SOLIDIFICATION POINTS OF MIXTURES OF MENTHOL AND SALOL. (Bellucci, 1912, 1913.)

t° of Solidification	42	30.5	28	28.5	32.5	41.9
Gm. Salol per 100 Gm. Mixture	100	80	60	40	20	0

METHANE CH_4.

SOLUBILITY IN WATER.
(Winkler, 1901.)

t°.	β.	β'.	q.	t°.	β.	β'.	q.
0	0.05563	0.05530	0.00396	40	0.02369	0.02198	0.00159
5	0.04805	0.04764	0.00341	50	0.02134	0.01876	0.00136
10	0.04177	0.04127	0.00296	60	0.01954	0.01571	0.00115
15	0.03690	0.03628	0.00260	70	0.01825	0.01265	0.00093
20	0.03308	0.03233	0.00232	80	0.01770	0.00944	0.00070
25	0.03006	0.02913	0.00209	90	0.01735	0.00535	0.00040
30	0.02762	0.02648	0.00191	100	0.01700	0	0

For the values of β, β' and q see Ethane, page 285.

SOLUPILITY OF METHANE IN METHYL ALCOHOL AND IN ACETONE.
(Levi, 1901, 1902.)

In methyl alcohol l (Ostwald expression, see page 227) = $0.5644 - 0.0046\,t - 0.00004\,t^2$.
In acetone l (Ostwald expression) = $0.5906 - 0.00613\,t - 0.000046\,t^2$.
From which are calculated the following values:

In Methyl Alcohol.				In Acetone.			
t°.	l.	t°.	l.	t°	l.	t°.	l.
0	0.5644	40	0.3164	0	0.5906	40	0.2718
10	0.5144	50	0.2344	10	0.5247	50	0.1691
20	0.4564	60	0.1444	20	0.4496	60	0.0572
30	0.3904	70	0.0464	30	0.3653		

SOLUBILITY OF METHANE IN SEVERAL ALCOHOLS AND OTHER SOLVENTS.
(McDaniel, 1911)

Solvent.	t°.	Abs. Coef. A.	Bunsen Coef. β.	Solvent.	t°.	Abs. Coef. A.	Bunsen Coef. β.
Alcohol:							
Methyl (99%)	22.1	0.4436	0.4102	Toluene	40.1	0.4675	0.4080
"	30.2	0.4278	0.3883	"	50.2	0.4545	0.4013
"	40	0.3938	0.3436	"	60	0.4502	0.3690
"	49.8	0.2695	0.2278	m Xylene	21.1	0.5146	0.4778
Ethyl (99.8%)	22.2	0.4628	0.4282	"	30.5	0.5028	0.4529
"	30.1	0.4503	0.4051	"	50	0.4972	0.4203
"	40	0.4323	0.3771	"	60	0.4870	0.3992
Isopropyl	21.5	0.4620	0.4275	Hexane	22.2	0.6035	0.5585
"	29.9	0.4532	0.4081	"	40.2	0.5320	0.4639
"	40	0.4400	0.3837	"	49.7	0.5180	0.4380
"	60.3	0.4244	0.3478	"	60	0.4964	0.4068
Amyl	22	0.4532	0.4196	Heptane	22.2	0.7242	0.6720
"	30.1	0.4444	0.4002	"	30.1	0.6906	0.6221
Benzene	22.1	0.4954	0.4600	"	40	0.6675	0.5820
"	35	0.4484	0.3976	Pinene*	20	0.4888	0.4565
"	40.1	0.4198	0.3661	"	30.1	0.4620	0.4163
"	49.9	0.3645	0.3081	"	39.1	0.4472	0.3914
Toluene	25	0.4852	0.4450	"	45	0.4440	0.3811
"	30	0.4778	0.4300	"	55.2	0.3694	0.3076

* b. pt. 155–160°.

Abs. coef. A = vol. of methane absorbed by unit vol. of solvent at temp stated.
For definition of Bunsen abs. coef. β see carbon dioxide, p. 227.

Solubility of Methane in Ethyl Alcohol.

(Bunsen, 1877, 1892.)

t°.	2°.	6.4°.	11°.	15°.	19°.	23.5°.
Abs. coef. β (found)	0.51721	0.50382	0.49264	0.48255	0.4729	0.4629

from which the following formula was calculated.

Bunsen abs. coef. β for methane $= 0.522745 - 0.00295882\,t - 0.0000177\,t^2$.

The solubility of methane in aq. H_2SO_4 (Christoff, 1906) in terms of the Ostwald solubility expression l_{20}. In 95.6% H_2SO_4, $l_{20} = 0.03303$; in 61.62% H_2SO_4, $l_{20} = 0.01407$; in 35.82% H_2SO_4, $l_{20} = 0.01815$; in H_2O, $l_{20} = 0.03756$.

The solubility of methane in ethyl ether, in terms of the Ostwald Solubility Expression l (see p. 227), is 1.066 at 0° and 1.028 at 10°. (Christoff, 1912.)

The coef. of absorption β (Bunsen) of methane in petroleum (Russian) is 0.144 at 10° and 0.131 at 20°. (Gniewosz and Walfisz, 1887.)

Fusion-point data are given for diphenyl *methane* + naphthalene by Miolati, (1892) and for diphenyl methane + phenol by Paterno and Ampola (1897).

Triphenyl **METHANE** $CH(C_6H_5)_3$.

Solubility in Aniline.

(Hartley and Thomas, 1906.)

By synthetic method, see page 16.

t°.	Gms. $CH(C_6H_5)_3$ per 100 Gms. Solution	Mol. per cent $CH(C_6H_5)_3$.	Solid Phase.	t°.	Gms. $CH(C_6H_5)_3$ per 100 Gms. Solution.	Mol. per cent $CH(C_6H_5)_3$.	Solid Phase.
23.0	5.4	1.85	$CH(C_6H_5)_3.C_6H_5NH_2$ rhombs	71.3	67.9	44.6	$CH(C_6H_5)_3.C_6H_5NH_2$ rhombs
35.3	9.5	3.8	"	71.6	71.7	49.1	"
43.0	13.5	5.6	"	71.2	76.3	55.1	"
52.1	21.9	9.7	"	70.6	78.3	57.9	"
61.4	36.5	17.8	"	71.6	82.1	63.5	$CH(C_6H_5)_3$ monoclinic
66.0	47.2	25.4	"	74.3	84.9	68.2	"
68.7	54.8	31.6	"	82.1	91.7	80.9	"
70.1	64.6	40.9	"	87.3	96.1	90.2	"

Solubility of Tri Phenyl Methane in Benzene.

(Linebarger — Am. Ch. J. 15, 45, '93.) (Hartley and Thomas.)

t°.	Gms $CH(C_6H_5)_3$ per 100 Grams C_6H_6	Solid Phase.	t°.	Gms. $CH(C_6H_5)_3$ per 100 Gms. Solution.	Mol. per cent $CH(C_6H_5)_3$.	Solid Phase.
3.9	3.90	$C_6H_6 + CH(C_6H_5)_3.C_6H_6$	33	12.6	4 4	$CH(C_6H_5)_3.C_6H_6$ rhombs
4.0	4.06	$CH(C_6H_5)_3.C_6H_6$	49 4	24.0	8.8	"
12.5	5.18	"	65.6	38.9	17.2	"
16.1	6.83	"	73.8	57.5	30.2	"
19.4	7.24	"	77.1	67.4	39.7	"
23.1	8.95	"	77.9	76.3	50.7	"
37.5	10.48	$(C_6H_5)_3CH.C_6H_6 + CH(C_6H_5)_3$	77.5	80.2	56.4	"
42.0	19.61	$CH(C_6H_5)_3$	76.2	84.1	62.8	"
44.6	22.64	"	74.6	87.5	69.1	$CH(C_6H_5)_3$ monoclinic
50.1	30.64	"	76.0	89.0	72.2	"
55.5	40.51	"	78.8	90.5	75.3	"
71.0	140.00	"	82.3	93.1	81.3	"
76.2	319.67	"	86.6	95.7	87.8	"

Hartley and Thomas call attention to the inaccuracy of Linebarger's results and to the correctness of the determinations of Kuriloff (1897a). According to Kuriloff the tr. pt. $(C_6H_5)_3CH.C_6H_6 + C_6H_6$ is at 4.2° and 1.25 mol. % $(C_6H_5)_3CH$, the m. pt. of $(C_6H_5)_3CH.C_6H_6$ is 78.2° and the tr. pt. $(C_6H_5)_3CH.C_6H_6 + (C_6H_5)_3.CH$ is at 74° and 69.4 mol. % $(C_6H_5)_3CH$.

Solubility of Tri Phenyl Methane in Carbon Bisulphide.

(Etard — Ann. chim. phys. [7] 2, 570, '94; below −80°, Arctowski — Z. anorg. Ch. 11, 273, '95.)

t°.	Gms. $CH(C_6H_5)_3$ per 100 Gms. Solution.	t°.	Gms. $CH(C_6H_5)_3$ per 100 Gms. Solution.	t°.	Gms. $CH(C_6H_5)_3$ per 100 Gms. Solution.
−113.5	0.98	−40	7.5	40	63.7
−102	1.24	−20	13.7	50	72.4
− 91	1.56	0	25.8	60	78.6
− 83	1.91	+10	38.7	70	85.6
− 60	3.4	20	43.2	80	92.2
		30	52.9		

Solubility of Tri Phenyl Methane in Hexane and in Chloroform. (Etard.)

t°.	Gms. $CH(C_6H_5)_3$ per 100 Gms. Solution in:		t°.	Gms. $CH(C_6H_5)_3$ per 100 Gms. Solution in:	
	Hexane.	Chloroform.		Hexane.	Chloroform.
−50	...	10.5	30	12.5	48.8
−30	1.2	15.2	40	20.0	56.1
−20	1.6	19.0	50	25.8	63.8
−10	2.2	23.5	60	45.7	71.7
0	3.5	28.9	70	62.0	79.8
+10	5.6	35.0	80	78.5	87.2
20	8.3	41.5	90	97.0	...

Solubility of Tri Phenyl Methane in:

(Hartley and Thomas.)

Pyrrole.				Thiophene.			
t°.	Gms. $CH(C_6H_5)_3$ per 100 Gms. Sol.	Mol. per cent $CH(C_6H_5)_3$.	Solid Phase.	t°.	Gms. $CH(C_6H_5)_3$ per 100 Gms Solution	Mol. per cent $CH(C_6H_5)_3$.	Solid Phase.
24.6	24.3	8 1	$CH(C_6H_5)_3.C_4H_4NH$	25.7	26.0	10.8	$CH(C_6H_5)_3.C_4H_4S$
29.0	29.8	10.4	" rhombs	33 5	31 1	13.5	" rhombs
31.5	33.4	12.1	"	44 0	43 6	21 1	"
36.8	40.6	15.8	$CH(C_6H_5)_3$	47 6	48.4	24.4	"
42.7	49.1	20.9	" monoclinic	53 5	58 7	32 9	"
46.9	56.0	25.9	"	57.4	70 2	44 7	"
53.2	63.9	32.8	"	57 6	74 8	50.6	"
60.0	72.3	41.8	"	62.7	78 7	56 0	$CH(C_6H_5)_3$
63.9	76.7	47.4	"	67.0	81.9	60 8	" monoclinic
68.5	81.9	55.6	"	67.2	82.1	61.3	"
71.1	84.4	59.8	"	74.2	87.4	70.5	"
80.0	91.5	74.8	"	79.0	90.3	76.3	"
89 2	97.6	91.8	"	87.2	96.2	89.9	"

F.-pt. data for triphenylmethane + naphthalene are given by Vignon (1891).

Solubility of Triphenyl Methane in Pyridine. (Hartley and Thomas, 1906.)

Synthetic method used, see note, p. 16.

t°.	Gms. $CH(C_6H_5)_3$ per 100 Gms. Solution.	Mol. per cent $CH(C_6H_5)_3$.	Solid Phase.	t°.	Gms. $CH(C_6H_5)_3$ per 100 Gms. Solution.	Mol. per cent $CH(C_6H_5)_3$.	Solid Phase.
22.8	46.2	22	$CH(C_6H_5)_3$	59.3	75.6	50.3	$CH(C_6H_5)_3$
31.7	53.3	27.2	" monoclinic	67.8	81.9	59.7	"
37.9	57.6	30.7	"	72.8	85.7	66.4	"
48.7	66.6	39.5	"	80.6	91.5	77.2	"
53.1	70.1	43.5	"	86.8	95.8	88.1	"

Ethyl and Methyl Sulfon METHANES.

SOLUBILITY IN WATER AND IN 90% ALCOHOL.

Compound.	Formula.	t°.	Gms. Cmpd per 100 cc: Water.	90% Alcohol.	Authority.
Sulfonal	$(CH_3)_2C(SO_2C_2H_5)_2$	15.5	0.22	1 25	(Greenish and Smith, 1903.)
Tetronal	$(C_2H_5)_2C(SO_2C_2H_5)_2$	15–20	0.18	8 33	(Squire and Caines, 1905.)
Trional	$(CH_3)(C_2H_5)C(SO_2C_2H_5)_2$	15–20	0.31	9.0	" " "

DISTRIBUTION BETWEEN WATER AND OLIVE OIL AT ROOM TEMP.
(Baum, 1899; Meyer, 1909)

Compound.	Formula.	Gms Cmpd per 100 cc. H_2O Layer (w).	Oil Layer (o).	Ratio (o)/(w).
Dimethyl Sulfon Dimethyl Methane	$(CH_3)_2C(SO_2.CH_3)_2$	0.6072	0.0622	0.103
Diethyl Sulfon Methane	$CH_2(SO_2C_2H_5)_2$	0.610	0.092	0.151
Sulfonal	$(CH_3)_2C(SO_2C_2H_5)_2$	0.070	0.0686	0.979
Trional	$(CH_3)(C_2H_5)C(SO_2\,C_2H_5)_2$	0.0404	0.1646	4.074
Tetronal	$(C_2H_5)_2C(SO_2.C_2H_5)_2$	0.0462	0.1446	3.756

METHYL ACETATE CH_3COOCH_3.

100 gms. H_2O dissolve 25 gms. CH_3COOCH_3 at 22°. (Traube, 1884.)

More recent data for the solubility of this compound in water are given by (Herz, 1917).

METHYL ALCOHOL CH_3OH.

FREEZING-POINTS OF MIXTURES OF METHYL ALCOHOL AND WATER.
(Pickering, 1893; Baumé and Borowski, 1914)

t°.	Gms CH_3OH per 100 Gms Sol.	Solid Phase.	t°.	Gms. CH_3OH per 100 Gms Sol.	Solid Phase.	t°.	Gms. CH_3OH per 100 Gms. Mixtures.	Solid Phase.
−10	14.5	Ice	−70	58.3	Ice	−130	75.5	Ice
−20	25	"	−80	62.6	"	−138.5 Eutec.	77	" $+CH_3OH$
−30	33	"	−90	65.7	"	−130	82	CH_3OH
−40	40	"	−100	68.8	"	−120	86.5	"
−50	47	"	−110	71.5	"	−110	92	"
−60	52.6		−120	74.0	"	−95 7	100	"

In the vicinity of the eutectic the solutions become vitreous and direct determinations of the f.-pt. cannot be made. The above results were obtained from the curve.

MISCIBILITY OF METHYL ALCOHOL (see Note, p. 287) AT 0° WITH MIXTURES OF:

Carbon Tetrachloride and Water. (Bonner, 1910) Chloroform and Water. (Bonner, 1910.)

Composition of Homogeneous Mixtures				Composition of Homogeneous Mixtures			
Gms. CCl_4.	Gms. H_2O.	Gms CH_3OH.	Sp Gr. of Mixture.	Gms $CHCl_3$.	Gms H_2O.	Gms. CH_3OH.	Sp Gr. of Mixture.
*0.985	0.015	0.215	...	0.979	0.021	0.161	...
0.974	0.026	0.328	1.30	0.90	0.10	0.35	1.17
0.90	0.10	0.74	1.13	0.80	0.20	0.49	1.12
0.80	0.20	1.10	1.04	*0.73	0.27	0.57	...
0.70	0.30	1.40	1	0.70	0.30	0.60	1.08
0.60	0.40	1.68	0.97	0.60	0.40	0.70	1.05
0.50	0.50	1.71	0.95	0.50	0.50	0.77	1.02
0.40	0.60	1.77	0.93	0.40	0.60	0.83	1
0.20	0.80	1.88	0.92	0.20	0.80	0.84	0.97
0.10	0.90	1.90	0.92	0.10	0.90	0.74	0.96
0.026	0.974	1.045	0.93	0.013	0.987	0.267	0.98

MISCIBILITY OF METHYL ALCOHOL (see Note, p. 287) AT 0° WITH MIXTURES of:

Brombenzene and Water. (Bonner, 1910.)

Composition of Homogeneous Mixtures.			
Gms. C_6H_5Br.	Gms H_2O.	Gms CH_3OH.	Sp. Gr. of Mixture.
0.991	0.009	0.230	...
0.985	0.015	0.314	1.24
*0.98	0.02	0.40	...
0.90	0.10	1.01	1.04
0.80	0.20	1.50	0.98
0.70	0.30	1.84	0.95
0.60	0.40	2.065	0.94
0.50	0.50	2.24	0.91
0.40	0.60	2.30	0.90
0.30	0.70	2.28	0.89
0.20	0.80	2.20	0.89
0.095	0.905	1.927	0.90
0.016	0.984	1.332	0.91

Ethyl Bromide and Water. (Bonner, 1910.)

Composition of Homogeneous Mixtures.			
Gms. C_2H_5Br.	Gms. H_2O.	Gms. CH_3OH.	Sp. Gr. of Mixture.
0.973	0.027	0.202	1.27
0.950	0.05	0.33	...
0.936	0.064	0.393	1.18
0.90	0.10	0.54	1.14
0.80	0.20	0.86	1.05
0.70	0.30	1.04	1.01
0.60	0.40	1.18	0.99
0.50	0.50	1.26	0.97
0.40	0.60	1.31	0.96
0.20	0.80	1.21	0.94
0.10	0.90	0.94	0.94
0.022	0.978	1.94	0.98

MISCIBILITY OF METHYL ALCOHOL (see Note, p. 287) AT 0° WITH MIXTURES OF:

Hexane and Water. (Bonner, 1910)

Composition of Homogeneous Mixtures.			
Gms Hexane(1).	Gms H_2O.	Gms CH_3OH.	Sp Gr of Mixture
0.973	0.067	4.280	...
0.90	0.10	4.69	0.80
0.80	0.20	5.26	0.80
0.691	0.309	5.710	0.82
0.60	0.40	6.17	0.81
0.491	0.509	6.365	0.83
0.40	0.60	6.33	0.83
0.30	0.70	6.13	0.84
0.20	0.80	5.49	0.85
0.10	0.90	4.01	0.86
0.016	0.984	1.759	0.91

Heptane and Water. (Bonner, 1910.)

Composition of Homogeneous Mixtures.			
Gms Heptane(1).	Gms H_2O	Gms CH_3OH	Sp Gr of Mixture.
0.966	0.034	4.78	...
0.90	0.10	5.55	0.80
0.793	0.207	6.36	0.82
0.70	0.30	7.30	0.82
0.60	0.40	8.22	0.82
0.50	0.50	8.76	0.82
0.40	0.60	8.65	0.83
0.30	0.70	7.78	0.83
0.198	0.802	6.71	0.84
0.10	0.90	4.40	0.87
0.038	0.962	2.96	0.91

(1) The hexane and heptane used were Kahlbaum's "aus Petroleum."

100 cc. cotton seed oil ($d_{25}=0.922$) dissolve 4.84 gms. CH_3OH at 25°. (Wroth and Reid, 1916.)

100 cc. methyl alcohol dissolve 6.74 gms. cotton seed oil at 25°. " "

DISTRIBUTION OF METHYL ALCOHOL BETWEEN WATER AND COTTON SEED OIL AT 25°. (Wroth and Reid, 1916)

Gms. CH_3OH per 100 cc. Oil Layer.	H_2O Layer.	Ratio.	Gms CH_3OH per 100 cc. Oil Layer.	H_2O Layer.	Ratio.
0.199	17.28	86.6	0.275	23.48	85.2
0.253	23.34	92.2	0.258	24.44	94
0.298	25.73	86.2	0.284	23.06	81.4
0.264	24.15	91.3			

Freezing-point curves (solubility, see footnote, p. 1) are given for the following mixtures: $CH_3OH + SO_2$, $CH_3OH + C_2H_5COOH$, $(CH_3OH.HCl) + C_2H_5COOH$, $(C_2H_5COOH.HCl) + CH_3OH$ (Baumé and Pamfil, 1914); $CH_3OH + NH_3$ (Baumé and Borowski, 1914); $CH_3OH + CH_3I$ (Baume and Tykociner, 1914).

METHYL AMINES CH_3NH_2, $(CH_3)_2NH$, $(CH_3)_3N$.

Freezing-point data (solubility, see footnote, p. 1) for mixtures of $CH_3NH_2 + H_2O$, $(CH_3)_2NH + H_2O$ and $(CH_3)_3N + H_2O$ are given by Pickering (1893).

The solubility of methylamine and of dimethylamine in water at 60°, calculated from the vapor pressures determined by an aspiration method are given by Doyer (1890) as follows:

Amine.	Vapor Pressure in mm. Hg.	Ostwald Solubility Coef l. (see p. 227).	Bunsen Abs. Coef. β. (see p. 227).
CH_3NH_2	40.6	511	419
$(CH_3)_2NH$	90.3	230	188

SOLUBILITY OF TRIMETHYL AMINE IN VARIOUS SOLVENTS AT 25°.

(v. Halban, 1913)

The measurements were made according to the dynamic method in the form developed by R. Abegg and his collaborators (Gaus, 1900; Abegg and Riesenfeld, 1902). The calculations of the partial pressures of the trimethylamine were made according to the Abegg and Riesenfeld method.

E = calc. partial pressure of $(CH_3)_3N$ above a 1 normal solution, based on Henry's Law.

λ = solubility, *i.e.*, the quotient of the concentration in the solution and in the gas phase: $\lambda = \frac{\text{mols. } (CH_3)_3N \text{ per liter} \times RT \times 760}{\text{partial pressure of } (CH_3)_3N \text{ in mm. Hg}}$, $RT \times 760 = 18{,}590$.

Solvent.	E.	λ.	Solvent.	E.	λ.	Solvent.	E.	λ.
Methyl Alc.	26.1	711	Acetophenone	321	57.9	Ethyl Acetate	220	84.5
Ethyl "	39.5	471	Ether	349	53.3	Ethyl Benzoate	244	76.2
Propyl "	39.4	472	Acetonitrile	292	63.7	Chloroform	31.1	598
Amyl "	48.3	385	Nitromethane	329	56.5	α Bromnaphthalene	409	47
Benzyl "	14.2	1308	o Nitrotoluene	340	54.7	Hexane	248	75
Acetone "	243	76.7	Nitrobenzene	350	53.1	Benzene	172	109

Two determinations are also given for triethyl amine:

λ_{25} in hexane = 2160. λ_{25} in nitromethane = 400.

METHYL AMINE AND TRI METHYL AMINE, DISTRIBUTION BETWEEN:

Water and Amyl Alcohol.

(Herz and Fischer — Ber. 37, 4751, '04)

Gms. $NH_2(CH_3)$ per 100 cc Aq. Layer.	Gms. $NH_2(CH_3)$ per 100 cc Alcoholic Layer.	Millimols $NH_2(CH_3)$ per 10 cc. Aq. Layer.	Millimols $NH_2(CH_3)$ per 10 cc. Alcoholic Layer.
0.37	0.12	1.155	0.3804
0.94	0.33	3.036	1.070
1.57	0.54	5.054	1.759
1.89	0.69	6.083	2.219
2.00	0.72	6.429	2.315
2.53	0.92	8.126	2.981
3.30	1.24	10.613	3.974

Water and Benzene.

(Herz and Fischer — Ber. 38, 1143, '05.)

Gms. $N(CH_3)_3$ per 100 cc. Aq Layer.	Gms. $N(CH_3)_3$ per 100 cc. C_6H_6 Layer.	Millimols $N(CH_3)_3$ per 10 cc. Aq. Layer.	Millimols $N(CH_3)_3$ per 10 cc. C_6H_6 Layer.
0.345	0.174	0.584	0.295
0.812	0.396	1.377	0.670
1.075	0.545	1.819	0.921
1.462	0.731	2.474	1.237
2.139	1.077	3.619	1.823
2.757	1.376	4.663	2.328
3.292	1.683	5.568	2.847
3.996	2.053	6.760	3.474
6.582	3.465	11.135	5.861

DISTRIBUTION OF METHYLAMINE BETWEEN WATER AND CHLOROFORM AND DIMETHYL AND TRIMETHYL AMINES BETWEEN WATER AND TOLUENE.

(Moore and Winmill, 1912.)

Amine.	Results at 18°. Gm. Equiv. per Liter Aq. Layer.	Partition Coef.	Results at 25°. Gm. Equiv. per Liter Aq Layer.	Partition Coef.	Results at 32.35°. Gm. Equiv. per Liter Aq. Layer.	Partition Coef.
$(CH_3)NH_2$	0.0817	8.496	0.1203	7.965	0.1399	5.99
"	0.0809	8.477	0.1312	8	0.0959	6
$(CH_3)_2NH$	0.0759	23.28	0.1203	19.013	0.1003	13.38
"	0.0975	23.29	0.1010	19.05	0.1043	13.36
$(CH_3)_3N$	0.0688	3.297	0.0677	2.?91	0.1182	1.815
"	0.0791	3.290	0.0641	2.297	0.1248	1.820

Similar data for the distribution of trimethylamine between water and toluene at 25° and at other temperatures are given by Hantzsch and Sebalt (1899) and Hantzsch and Vagt (1901).

DiMETHYL AMINE HYDROCHLORIDE $(CH_3)_2NH.HCl$.

100 gms. H_2O dissolve 369.2 gms. $(CH_3)_2NH.HCl$ at 25°. (Peddle and Turner, 1913.)
100 gms. $CHCl_3$ dissolve 16.91 gms. $(CH_3)_2NH.HCl$ at 25°. " "

Phenyl **METHYL AMINE HYDROCHLORIDE** $(CH_3)(C_6H_5)NH.HCl$.

100 gms. H_2O dissolve 378.8 gms. $(CH_3)(C_6H_5)NH.HCl$ at 25°. (Peddle and Turner, '13.)

Di and Tri**METHYL AMINE CHLOROPLATINATES**, $(CH_3)_2NH.H_2PtCl_6$, $(CH_3)_3N.H_2PtCl_6$.

SOLUBILITY OF EACH IN AQ. ALCOHOL AT 0°. (Bertheaume, 1910.)

Solvent.	Gms. Each Compound (Determined Separately) per 100 Gms. Solvent. $(CH_3)_2NH.H_2PtCl_6$.	$(CH_3)N.H_2PtCl_6$.
Absolute Alcohol	0.0048	0.0036
90° "	0.110	0.070
80° "	0.325	0.243
70° "	0.558	0.391
60° "	0.996	0.766

METHYL BUTYRATE $C_3H_7COOCH_3$.

100 gms. H_2O dissolve 1.7 gms. $C_3H_7COOCH_3$ at 22°. (Traube, 1884.)
More recent data for the solubility of methyl butyrate in water are given by Herz, 1917.

METHYL BUTYRATE, METHYL VALERATE.

SOLUBILITY OF EACH IN AQUEOUS ALCOHOL MIXTURES.

(Bancroft, 1895; from Pfeiffer, 1892.)

100 cc. H_2O dissolve 1.15 cc. methyl butyrate at 20°.

cc Alcohol in Mixture.	cc H_2O Added.* Butyrate.	Valerate.	cc Alcohol in Mixture.	cc. H_2O Added.* Valerate.
3	2.34	1.66	27	44.15
6	6.96	5.06	30	52.37
9	12.62	9.03	33	62.25
12	19.45	13.40	36	74.15
15	28.13	18.41	39	91.45
18	38.80	24	42	∞
21	55.64	30.09		
24	∞	36.72		

* cc. H_2O added to cause the separation of a second phase in mixtures of the given amounts of ethyl alcohol and 3 cc. portions of methyl butyrate and of methyl valerate respectively.

METHYL ETHER $(CH_3)_2O$.

F.-pt. curves are given for $(CH_3)_2O + H_2O$ (Baumé and Perrot, 1914); $(CH_3)_2O + C_2H_2$, $(CH_3)_2O + SO_2$ (Baumé, 1914); $(CH_3)_2O + NO$ (Baumé and Germann, 1914); $(CH_3)_2O + CO_2$ (Baumé and Borowski, 1914).

METHYL IODIDE, Methylene Chloride and Methylene Bromide.

SOLUBILITY OF EACH IN WATER. (Rex, 1906.)

t°.	Gms. per 100 Gms. H_2O.		
	CH_3I.	CH_2Cl_2.	CH_2Br_2.
0	1.565	2.363	1.173
10	1.446	2.122	1.146
20	1.419	2	1.148
30	1.429	1.969	1.176

Fusion-point data for methyl iodide + pyridine are given by Aten (1905–06).

METHYL ORANGE $H_2NC_6H_4.N_2.C_6H_4SO_3Na$.

100 gms. H_2O	dissolve	0.02 gm. methyl orange at 20–25°.	(Dehn, 1917.)
" pyridine	"	1.80 " " "	"
" aq. 50% pyridine	"	51.5 " " "	"

METHYL OXALATE $(CH_3)_2C_2O_4$.

100 gms. H_2O	dissolve	6.18 gms. $(CH_3)_2C_2O_4$ at 20–25°.	(Dehn, 1917)
" pyridine	"	4.8 " " "	"
" aq. 50% pyridine	"	93.1 " " "	"
" 95 % formic acid	"	22.58 " " at 20.2°	(Aschan, 1913.)

F.-pt. data for $(CH_3)_2C_2O_4 + H_2O$ are given by Skrabal (1917).

METHYLENE BLUE $(CH_3)_2N.C_6H_3(NS)C_6H_3{:}N(CH_3)_2Cl$.

100 gms. H_2O	dissolve	4.36 gms. methylene blue at 20–25°.	(Dehn, '17.)
" pyridine	"	0.26 " " "	"
" aq. 50% pyridine	"	0.74 " " "	"

Data for the distribution of methylene blue between aniline and water are given by Pelet-Jolivet (1909).

METHYL PROPIONATE $C_2H_4COOCH_3$.

100 gms. H_2O dissolve 5 gms. $C_2H_5COOCH_3$ at 22°. (Traube, 1881)

More recent data for the solubility of methyl propionate in water are given by Herz (1917).

METHYL SALICYLATE $C_6H_4OH.COOCH_3$.

100 cc. H_2O dissolve 0.074 gm. $C_6H_4OH.COOCH_3$ at 30°. (Gibbs, 1908)

100 cc. 0.1 *n* H_2SO_4 dissolve 0.077 gm. $C_6H_4OH.COOCH_3$ at 30°. "

SOLUBILITY OF METHYL SALICYLATE IN AQUEOUS ALCOHOL AT 25°. (Seidell, 1910)

Wt % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms C_6H_4OH-$COOCH_3$ per 100 Gms Sat Sol.	Wt % C_2H_5OH in Solvent.	d_{25} of Sat Sol.	Gms C_6H_4OH-$COOCH_3$ per 100 Gms. Sat. Sol.
0	1	0.12	60	0.923	18.60
30	0.958	0.60	65	0.929	30.50
40	0.940	2.30	70	0.943	39.40
50	0.925	6.20	75	0.974	58.50
55	0.922	10	80	1.050	72

SOLUBILITY OF METHYL SALICYLATE IN AQUEOUS ALCOHOL AT DIFFERENT TEMPERATURES. (Seidell, 1910)

Wt. % C_2H_5OH in Solvent.	Gms C_6H_4OH $COOCH_3$ per 100 cc Solvent at:			
	15°.	20°.	25°.	30°.
0	(about) 0.1	0.1	0.1	0.1
30	0.3	0.4	0.5	0.6
40	0.8	1.1	1.4	1.8
50	2.4	3.5	5	6
55	4.2	6	7.8	9.5
60	7.7	10	12.5	15.5
65	13	16.5	20.2	24.5
70	22	28	33	40
75	43	52	62	72
80	92	135	180	230

METHYL SULFATE $(CH_3)_2SO_4$.

RECIPROCAL SOLUBILITY OF METHYL SULFATE AND OIL OF TURPENTINE.

The determinations were made by the synthetic method (sealed tubes).

The d_{25} of the oil of turpentine, $C_{10}H_{16}$, was 0.8602, its absolute index of refraction for yellow light at 25° was 1.467 and its rotation in a 100-mm. tube was −32.25°.

t°.	Gms. $(CH_3)_2SO_4$ per 100 Gms. $(CH_3)_2SO_4$ Rich Layer.	Gms. $(CH_3)_2SO_4$ per 100 Gms. $C_{10}H_{16}$ Rich Layer.	t°.	Gms. $(CH_3)_2SO_4$ per 100 Gms. $(CH_3)_2SO_4$ Rich Layer.	Gms. $(CH_3)_2SO_4$ per 100 Gms. $C_{10}H_{16}$ Rich Layer.
30	95	4	80	87	13
40	93	5	90	84	17
50	92	6	100	76	27
60	91	8	105	68	37
70	89	10	108.2 (crit. t.)	50.5	

The results are influenced appreciably by the age and purity of the products and by the length of time the mixtures are kept in the sealed tubes. Somewhat different results were obtained with a sample of turpentine containing 5 vol. % of white spirit.

MICHLER'S KETONE (Tetramethyl-p$_2$-diamidobenzophenone) $CO[C_6H_4(4)\text{-}N(CH_3)_2]_2$.

100 gms. H_2O	dissolve 0.04 gm. of ketone at 20–25°.	(Dehn, 1917)
" pyridine,	" 9.92 " " "	"
" aq. 50% pyridine	" 3.59 " " "	"

MOLYBDENUM TRIOXIDE (Molybdic acid dihydrate) $MoO_3.2H_2O$.

SOLUBILITY IN WATER. (Rosenheim and Bertheim, 1903.)

t°.	Gms. MoO_3 per 1000 Gms. Sat. Solution.	Gms. MoO_3 per 1000 Gms. H_2O.	t°.	Gms. MoO_3 per 1000 Gms. Sat. Solution.	Gms. MoO_3 per 1000 Gms. H_2O.
18	1.065	1.066	59	10.117	11.258
23	1.822	1.856	60	10.760	12.057
30	2.570	2.638	66	14.730	17.274
40	4.541	4.761	70	17.048	20.550
48	5.980	6.360	74.4	17.290	20.904
50.2	6.431	6.873	75	17.300	20.920
54	7.283	7.855	79	17.400	21.064

When a solution of the dihydrate is held at 40–50°, considerable amounts of crystals, designated by the authors as α molybdic acid monohydrate, separate. They differ from the β molybdic acid monohydrate obtained by direct conversion of the dihydrate at 70°, in being better crystals and in yielding solutions which can be filtered.

SOLUBILITY OF α MOLYBDIC ACID MONOHYDRATE IN WATER.
(Rosenheim and Davidsohn, 1903.)

t°.	Gms. MoO_3 per 1000 Gms. Sat. Solution.	Gms. MoO_3 per 1000 Gms. H_2O.	t°.	Gms. MoO_3 per 1000 Gms. Sat. Solution.	Gms. MoO_3 per 1000 Gms. H_2O.
14.8	2.112	2.117	45	3.648	3.661
24.6	2.612	2.619	52	4.167	4.184
30.3	2.964	2.973	60	4.665	4.685
36.8	3.284	3.295	70	4.213	4.231
42	3.434	3.446	80	5.185	5.212

SOLUBILITY OF MOLYBDIC ACID DIHYDRATE IN AQ. AMMONIUM SALT SOLUTIONS. (R. and D., 1903.)

t°.	Solvent.	Gms. MoO_3 per 1000 Gms. Sat. Solution.	Gms. MoO_3 per 1000 Gms. Solvent.
29.6	10% $(NH_4)_2SO_4$	18.91	19.27
31.5	10% NH_4HSO_4	26.79	27.53
41.8	"	33.22	34.36
49.7	"	36.32	37.69

Fusion-point data for $MoO_3 + Na_2MoO_4$ are given by Groschuff (1908).

MORPHINE $C_{17}H_{19}NO_3.H_2O$.

SOLUBILITY IN SEVERAL SOLVENTS.
(U. S. P.; Müller, W., 1903.)

Solvent.	Gms. Morphine per 100 Gms. Solution. At 18°–22°.	At 25°.	At 80°.	Solvent.	Gms. Morphine per 100 Gms. Solution. At 18°–22°.	At 25°.
Water	0.0283	0.030	0.0961	Chloroform	0.0655	0.0555
Alcohol	...	0.600	1.31 (60°)	Amyl Alcohol	...	0.8810
Ether	0.0131	0.0224	...	Ethyl Acetate	0.1861	0.1905
Ether sat. with H_2O	0.0094	...	...	Petroleum Ether	0.0854	...
H_2O sat. with Ether	0.0447	...	...	Carbon Tetrachloride	0.0156	0.032 (17°)
Benzene	0.0625	...	...	Glycerol	0.45 (15.5°)	...
Water	0.0254 (20°) (Winterstein, 1909)			CCl_4	0.025 (20°) (Gori, 1913)	
Chloroform	0.0504 (20°) "			Aniline	6.1 (20°) (Schultz, 1912.)	
Water	0.0288 (15°) (Guerin, 1913)			Pyridine	16 (20°) "	
Acetone	0.128 (15°) "			Piperidine	39.8 (20°) "	
Aq. 50 Vol. % Acetone	0.132 (15°) "			Diethylamine	7.41 (20°) "	
Water	0.0217 (20°) (Zalai, 1910)			50% Aq. Glycerol + 3% H_3BO_3	5.2 (r. temp.) (Baroni and Barlinetto, 1911.)	
Water	0.0192 (20°) (Guild, 1907.)					

SOLUBILITY OF MORPHINE IN SEVERAL SOLVENTS AT 25°.
(Schaefer, 1913)

Solvent.	Gms. $C_{17}H_{19}NO_3.H_2O$ per 100 cc. Solvent.	Solvent.	Gms. $C_{17}H_{19}NO_3.H_2O$ per 100 cc. Solvent.
Ethyl Alcohol	0.388	1 Vol. C_2H_5OH+4 Vols. $CHCl_3$	0.66
Methyl Alcohol	6.66	" +4 Vols. C_6H_6	0.2
Chloroform	0.04	1 Vol. CH_3OH +4 Vols. $CHCl_3$	4.54
Benzene	insol.	" +4 Vols. C_6H_6	2.5

SOLUBILITY OF MORPHINE IN ETHYL ETHER AT 5.5°.
(Marchionneschi, 1907.)

Solvent.	Gms. Morphine per 100 Gms. Sat. Sol.	Solid Phase.
Washed and Distilled Ether	0.049	$C_{17}H_{19}NO_3.H_2O$
Ether Purified by Distillation over Na	0.263	"
" " " "	0.56	$C_{17}H_{19}NO_3$

SOLUBILITY OF MORPHINE IN AQUEOUS SOLUTIONS OF SALTS AND BASES AT ROOM TEMPERATURE, SHAKEN EIGHT DAYS.
(Dieterich, 1890.)

Aq. Salt or Base.	In N/10 Salt or Base. Grams per Liter. Salt or Base.	Morphine.	In N/1 Salt or Base. Grams per Liter. Salt or Base.	Morphine.
NH_4OH	3.51	0.20	35.08	0.505
$(NH_4)_2CO_3$	4.80	0.031	48.03	0.040
KOH	4.62	2.78	46.16	...
K_2CO_3	6.92	0.20	69.15	0.379
$KHCO_3$	10.02	0.024	100.16	0.040
NaOH	4.00	3.33	40.05	...
Na_2CO_3	5.30	0.09	53.03	0.14
$NaHCO_3$	8.41	0.032	84.06	0.044
$Ca(OH)_2$ (sat.)	...	1.00 (25°)	...	...

MORPHINE ACETATE $CH_3COOH.C_{17}H_{19}NO_3.3H_2O$, Morphine Hydrochloride $HCl.C_{17}H_{19}NO_3.3H_2O$, Morphine Sulphate $H_2SO_4.(C_{17}H_{19}NO_3)_2.5H_2O$, and Apo Morphine Hydrochloride $HCl.C_{17}H_{17}NO_2$.

SOLUBILITY IN SEVERAL SOLVENTS.

(U. S. P.)

Solvent.	Grams per 100 Grams of Solvent. Acetate. 25°.	Acetate. 80°.	Hydrochloride. 25°.	Hydrochloride. 80°.	Sulphate. 25°.	Sulphate. 80°.	Apo M. Hydrochloride. 25°.	Apo M. Hydrochloride. 80°.
Water	44.9	50.0	5.81	200.0	6.53	166.6	2.53	6.25
Alcohol	4.6	40.0*	2.4	2.8*	0.22	0.53*	2.62	3.33
Chloroform	0.21	...	...	...	...	...	0.026	...
Ether	...	...	...	...	...	...	0.053	...
Glycerine	19.2	...	20.0†	...	...	...	...	...

* 60°. † 15.5°.

100 gms. H_2O dissolve 1.69 gms. apo morphine hydrocloride at 15.5°, and 2.04 gms. at 25°.

100 gms. 90% alcohol dissolve 1.96 gms. apo morphine hydrochloride at about 15.5°. (Dott, 1906.)

100 gms. H_2O dissolve 4.17 gms. morphine hydrated sulfate $.5H_2O$ at 15°. (Power, 1882)

MORPHINE SALTS (con.)

SOLUBILITY IN WATER AND IN 90% ALCOHOL AT ORD. TEMP.

(Squire and Caines, 1905)

Morphine Salt.	Gms Salt per 100 cc. H_2O.	90% Alcohol.	Morphine Salt.	Gms. Salt per 100 cc. H_2O.	90% Alcohol.
Morphine Acetate	...	1	Diacetyl Morphine (Heroine)	0 11	2.5
" Hydrochloride	...	2	" " HCl	50	9.1
" Sulfate	...	0 143	Ethyl Morphine HCl (Dionin)	14.3	20
" Tartrate	10	0 172			

100 gms. 4% $HClO_4$ solution dissolve 0.44 gm. morphine perchlorate at 15°. (Hofmann, Roth, Höbald and Metzler, 1910.)

SOLUBILITY OF MORPHINE SALTS IN SEVERAL SOLVENTS AT 25°.

(Schaeffer, 1913)

Solvent.	Gms. of Each Salt Separately per 100 cc. of Each Solvent. Morphine Hydrochloride.	Morphine Sulfate.	Diacetyl Morphine.	Diacetyl Morphine HCl.	Ethyl Morphine HCl.
95% Ethyl Alcohol	0.606	0.2	3	9.1	4
85% Ethyl Alcohol	1.2	0.4	...	...	...
80% Ethyl Alcohol	2	0.77	...	...	...
Methyl Alcohol	...	...	4	11.1	66.6
Chloroform	Insol.	Insol.	66.6	33.3	0.526
Benzene	Insol.	Insol.	12.5	Insol.	Insol.
1 Vol. C_2H_5OH+4 Vols. $CHCl_3$	0.18	0.0164	66.6	4.5	5
" +4 Vols. C_6H_6	0.089	0.0133	25	0.71	1.14
1 Vol. CH_3OH +4 Vols. $CHCl_3$	...	0.22	66.6	20	20
" +4 Vols. C_6H_6	0.253	0.066	25	6.6	8.33

Ethyl **MORPHINE** $C_{17}H_{17}ON(OH)(OC_2H_5)$.

100 cc. H_2O dissolve 0.208 gm. $C_{17}H_{17}OH(OH)(OC_2H_5)$ at 25°. (Schaeffer, 1912.)
" alcohol " 1.33 gms. " " "
" ether " 66.6 " " " "

Ethyl MORPHINE HYDROCHLORIDE $C_{17}H_{17}NO(OH)(OC_2H_5).HCl.2H_2O$ (Dionin) (see also on preceding page).

SOLUBILITY IN WATER AND IN ALCOHOL. (Schaeffer, 1912.)

t°.	Gms. Ethyl Morphine HCl per 100 cc. Water.	Alcohol.
15	8.7	3.85
25	12.5	5
40	25	12.1
50	40	20

These results differ from similar data for commercial samples of Dionin. The differences are believed to be due to the impurities (amorphous salts of the by-products of the ethylation) in commercial products.

100 cc. H_2O dissolve 10 gms. ethyl morphine hydrochloride at ord. temp. (Dott, 1912.)

MUSTARD OIL Allyl Isothiocyanic Ester $CS:NC_3H_5$.

SOLUBILITY IN SULFUR BY SYNTHETIC METHOD. (See Note, p. 16.)

(Alexejew, 1886.)

t°.	Gms. Mustard Oil per 100 Gms. Sulfur Layer.	Mustard Oil Layer.
90	10	72
100	12	67
110	15	62
120	23	51
124 (crit. temp.)	35	

Freezing-point data for allyl isothiocyanate + aniline are given by Kurnakov and Solovev (1916). Results for methyl isothiocyanate + phenanthrene and methyl isothiocyanate + naphthalene are given by Kurnakov and Efrenov (1912).

MYRISTIC ACID $C_{13}H_{27}COOH$.

SOLUBILITY IN ALCOHOLS. (Timofeiew, 1894.)

Alcohol.	t°.	Gms $C_{13}H_{27}COOH$ per 100 Gms. Sat. Sol.	Alcohol.	t°.	Gms. $C_{13}H_{27}COOH$ per 100 Gms. Sat. Sol.
Methyl Alcohol	0	2.81	Propyl Alcohol	0	5.6
" "	21	21.2	" "	21	31.2
" "	31.5	59.2	" "	36.5	55.3
Ethyl Alcohol	0	7.14	Isobutyl Alcohol	0	6.4
" "	21	31	" "	21	28

Freezing-point data for myristic acid + palmitic acid are given by Heintz (1854).

NAPHTHALENE $C_{10}H_8$.

1000 cc. H_2O dissolve 0.019 gm. $C_{10}H_8$ at 0° and 0.030 gm. at 25°. (Hilpert, 1916.)

SOLUBILITY IN ACETIC AND OTHER ACIDS. (Timofeiew, 1894.)

Acid.	t°.	Gms. $C_{10}H_8$ per 100 Gms. Acid.	Acid.	t°.	Gms $C_{10}H_8$ per 100 Gms. Acid.
Acetic Acid	6.75	6.8	Isobutyric Acid	6.75	12.3
" "	21.5	13.1	Propionic Acid	6.75	13.9
" "	42.5	31.1	" "	21.5	23.4
" "	51.3	53.5	" "	50	79.8
" "	60	111	Valeric Acid	6.75	9.5
Butyric Acid	6.75	13.6	" "	21.5	17.7
" "	21.5	22.1	" "	65	167.4
" "	60	131.6			

Solubility of Naphthalene in Aqueous Ammonia.

(Hilpert, 1916.)

Solvent.	Gms. $C_{10}H_8$ per 1000 Gms. Solvent at: 0°.	25°.
Aq. 5% NH_3	0.030	0.044
Aq. 10% NH_3	0.042	0.074
Aq. 25% NH_3	0.064	0.162
100% NH_3	33	120
Aq. 2% Pyridine	0.082	0.245

Solubility in Methyl, Ethyl, and Propyl Alcohols.

(Speyers—Am. J. Sci. [4] 14, 294, '02; at 19.5°, de Bruyn—Z. physik. Chem. 10, 784, '92; at 11°, Timofeiew—Compt. rend. 112, 1137, '91.)

The original results were calculated to a common basis, plotted on cross-section paper, and the following table read from the curves.

t°.	In Methyl Alcohol. Wt. of 1 cc. Solution.	Gms $C_{10}H_8$ per 100 Gms. CH_3OH.	In Ethyl Alcohol. Wt. of 1 cc. Solution.	Gms. $C_{10}H_8$ per 100 Gms. C_2H_5OH.	In Propyl Alcohol. Wt. of 1 cc. Solution.	Gms. $C_{10}H_8$ per 100 Gms. C_3H_7OH.
0	0.8194	3.48	0.8175	5.0	0.8285	4.45
10	0.812	5.6	0.814	7.0	0.824	5.6
20	0.807	8.2	0.810	9 8	0.821	8.2
25	0.805	9.6	0.809	11.3	0.820	9.6
30	0 804	11.2	0.809	13.4	0.820	11.4
40	0.805	16.2	0.812	19 5	0.823	16.4
50	0.813	26 0	0.822	35 0	0.837	26.0
60	0.837	50.0	0 855	67.0	0.867	50.0
65	0.870	...	0.890	96.0	0.897	80.0
70	0.9023 (68°)	...	0.930	179.0	0.933	134.1 (68.5°)

Equilibrium in the System Naphthalene, Acetone, Water.

(Cady, 1898)

An excess of naphthalene was added to each of a series of mixtures of water and acetone and the temperature determined at which a second liquid phase first appeared. Since an excess of naphthalene was present, the amount dissolved was not known. The following supplementary experiment was, therefore, required to ascertain the composition of the saturated solution in each case. "A weighed quantity of naphthalene was added to a known weight of the mixed liquids, the amount being just sufficient to cause the formation of two liquid phases. The consolute temperature of the system was then determined and the experiment repeated several times with different amounts of naphthalene. If the results are plotted, using the weights of naphthalene in a constant quantity of the mixed liquids as abscissas and the temperatures as ordinates, we shall get a series of curves. The composition of the liquid phase at the moment when the system passes from solid, solution and vapor to solid, two solutions and vapor is given by the point at which the prolongation of the curve for that particular mixture of acetone and water, cuts the ordinate for temperature at which the change takes place. This method requires no analysis and is of advantage in this case where ordinary quantitative analysis would be very difficult." Considerable difficulty was experienced in determining the consolute temperatures. It was necessary on account of the extreme volatility of the acetone to seal the mixtures in tubes.

The table of results, calculated with the aid of the determinations made as described above, is given on the following page.

TABLE SHOWING THE TEMPERATURES AT WHICH SOLUTIONS OF THE GIVEN COMPOSITIONS BEGIN TO SEPARATE INTO TWO LAYERS IN PRESENCE OF SOLID NAPHTHALENE. (Cady, 1898.)

(Calculated as described on preceding page.)

t°.	Gms. per 100 Gms. Solution. Acetone.	Water.	Naphthalene.
65.5	10	89.92	0.08
53.3	19.91	80	0.09
45	29.92	69.67	0.41
38	40.81	58.22	0 97
32.2	48.67	48.68	2.65
28.5	57.43	36.64	5.93
28.2	60.43	25.75	13.82

The isotherms for intervals of 10° lie so close together that they are practically indistinguishable for the greater part of their length.

SOLUBILITY OF NAPHTHALENE IN LIQUID CARBON DIOXIDE.
(Büchner, 1905-06) (Synthetic Method used.)

Crit. Temp.	Gms. $C_{10}H_8$ per 100 Gms. Sat. Sol.
34.8	8
64	54
80	100

100 gms. 95% formic acid dissolve 0.30 gm. naphthalene at 18.5°. (Aschan, 1913.)
100 gms. 95% formic acid dissolve 3.44 gms. α nitronaphthalene at 18.5°. "
Data for equilibrium in the systems: naphthalene, phenol, water and naphthalene, succinic acid nitrile, water, determined by the synthetic method, are given by Timmermans (1907).

SOLUBILITY OF NAPHTHALENE IN:

t°.	Chloroform. (Speyers; Etard) Wt of 1 cc. Solution.	Gms. $C_{10}H_8$ per 100 Grams $CHCl_3$.	Carbon Tetra Chloride. (Schröder — Z. physik. Ch. 11, 457, '93.) Gms. $C_{10}H_8$ per 100 Gms Sat. Solution.	Carbon Di Sulphide. (Arctowski — Compt. rend. 121, 123, '95, Etard.) Gms. $C_{10}H_8$ per 100 Gms. Sat. Solution.
−108	...	...	...	0.62
− 82	...	...	...	1.38
− 50	...	...	...	2.3
− 30	...	8 8	...	6.6
− 10	...	15 6	...	14.1
0	1.393	19 5	9.0	19.9
+ 10	1.355	25 5	14.0	27.5
20	1.300	31.8	20.0	36.3
25	1.280	35.5	23.0	41.0
30	1.255	40.1	26.5	46.0
40	1.205	49.5	35.5	57.2
50	1.150	60.3	47.5	67.6
60	1.090	73.1	62.5	79.2
70	1.040	87.2	80.0	90.3

NOTE. — Speyers' results upon the solubility of $C_{10}H_8$ in $CHCl_3$, when calculated to grams per 100 grams of solvent, agree quite well with Etard's (Ann. chim. phys. [7] 2 570, '94 figures, reported on the basis of grams $C_{10}H_8$ per 100 grams saturated solution.

SOLUBILITY OF NAPHTHALENE IN:
(Schröder; Etard; Speyers.)

t°.	Benzene. Gms. $C_{10}H_8$ per 100 Gms. Solution.	Chlor Benzene. Gms. $C_{10}H_8$ per 100 Gms. Solution.	Hexane. Gms. $C_{10}H_8$ per 100 Gms. Solution.	Toluene. Wt. of 1 cc. Solution.	Toluene. Gms. $C_{10}H_8$ per 100 Gms. $C_6H_5.CH_3$.
−50	...	...	0.3	...	...
−20	...	...	1.9	...	...
0	...	...	5.5	0.9124	...
+10	27.5	24.0	9.0	0.9126	15.0
20	36.0	31.0	14.0	0.9135	28.0
25	40.5	35.0	17.5	0.9155	36.0
30	45.5	39.0	21.0	0.9180	42.0
40	54.0	48.0	30.8	0.9250	56.0
50	65.0	57.5	43.7	0.9350	69.5
60	77.5	70.5	60.6	0.9475	83.0
70	88.0	85.0	78.8	0.9640	97.5
80	...	...	...	0.9770	111.0

Freezing-point data (solubility, see footnote, p. 1) are given for mixtures of naphthalene and each of the following compounds:

α Naphthol. (Crompton & Whitely, 1895; Küster, '95; Vignon, '91; Miers & Isaac, '08a.)
β Naphthol. (Crompton & Whitely, 1895; Vignon, 1891; Isaac, 1908)
α Naphthylamine. (Vignon, 1891.)
β " "
Dihydronaphthalene. (Küster, 1891)
Nitronaphthalene. (Palazzo & Battelli, 1883)
Palmitic Acetic Ester. (Batelli & Martinetti, '85.)
Paraffin. (Palazzo & Battelli, 1883)
Phenanthrene. (Vignon, 1891; Miolati, 1897.)
Phenol. (Yamamoto, '08; Hatcher & Skirrow, '17)
o Nitrophenol. (Saposchnikow, '04; Kremann, '04)
p Nitrophenol. (Kremann, 1904.)
2.4 Dinitrophenol. } (Saposchnikow, 1904;
Picric Acid. } Kremann, 1904.)
Pyridine. (Hatcher & Skirrow, 1917.)
Pyrocatechol. (Kremann & Janetzky, 1912.)
Resorcinol. (Vignon, 1891; Kremann & Janetzky, 1912)
Stearic Acid. (Courtonne, 1882.)
Sulfur. (Bylert, .)
Nitrotoluene. (Kremann, 1904)
1.2.4 Dinitrotoluene. "
1.2.6 " (Kremann & Rodinis, 1906.)
1.3.4 " " "
1.3.5 " " "
Trinitrotoluene. (Kremann, 1904.)
p Toluidine. (Vignon, 1891.)
Thymol. (Roloff, 1895.)

F.-pt. data are also given for the following mixtures:

Nitronaphthalene + Paraffin. (Campetti & Delgrosso, 1913; Palazzo & Batelli, 1883.)
1 Nitronaphthalene + Urethan. (Mascarelli, 1908)
1 Nitronaphthalene + α Naphthylamine. (Tsakalotos, 1912.)

β NAPHTHALENE SULFONIC ACID $C_{10}H_7SO_3H$.

SOLUBILITY IN AQUEOUS HYDROCHLORIC ACID AT 30°.
(Masson, 1912.)

d_{30} of Sat. Solution.	Mols. per Liter Sat. Sol. HCl.	Mols. per Liter Sat. Sol. $C_{10}H_7SO_3H$.	Gms. per Liter Sat. Sol. HCl.	Gms. per Liter Sat. Sol. $C_{10}H_7SO_3H$.
1.1925	0	3.263	0	679
1.1653	1.291	2.470	47.08	514
1.1553	1.826	2.117	66.59	440.6
1.1115	4.017	0.762	146.5	158.6
1.1197	7.232	0.089	263.7	18.5
1.1569	9.88	0.063	360.3	13.1

β NAPHTHOIC ACID $C_{10}H_7COOH$.

One liter of aqueous solution contains 0.058 gm. $C_{10}H_7COOH$ at 25°. (Paul, 1894.)

Dihydro **β NAPHTHOIC ACIDS** $C_{10}H_9COOH$ (118° and 161° isomers).

SOLUBILITY OF EACH ISOMER, DETERMINED SEPARATELY, IN WATER.
(Derick and Kamm, 1916.)

t°.	cc. 0.01 n $Ba(OH)_2$ Solution Required per 10 cc. of the Sat. Solution of the. 118° Isomer.	161° Isomer.
0	0.39	0.19
20	0.56	0.34
40	1.34	0.69
55-56	2.89	1.45
71-72	6.7	3.48
80	9.3	4.68
90	14.6	8
96-97	20.1	10.5

β NAPHTHOL $C_{10}H_7OH$.

SOLUBILITY IN WATER.

t°.	Gms β $C_{10}H_7OH$ per 100 cc. Sat. Sol.	Authority.
12.5	0.044	(Kuriloff, 1897.)
25.1	0.074	(Küster, 1895.)
29.5	0.0876	(Kuriloff, 1898)

Data for the solubility of isomorphous mixtures of β naphthol and naphthalene in water at 25.1° are given by Küster (1895).

SOLUBILITY OF β NAPHTHOL IN AQUEOUS SOLUTIONS OF PICRIC ACID AT 29°.
(Kuriloff, 1898)

Mols. × 10^5 per 100 cc. Solution. $C_6H_2.OH(NO_2)_3$.	$C_{10}H_7OH$.	Gms per 100 cc Solution. $C_6H_2OH(NO_2)_3$	$C_{10}H_7OH$.	Solid Phase.
0	609	0	0.0877	β Naphthol
54	615	0.0124	0.0886	"
68.5	620	0.0157	0.0894	" +β Naphtholpicrate
69	607	0.0158	0.0875	β Naphtholpicrate
69	597	0.0158	0.0860	"
88	494	0.0212	0.0712	"
100	390	0.0229	0.0562	"
196	180	0.0449	0.0259	"
308	105	0.0706	0.0151	"
933	8	0.2138	0.0011	" +Picric Acid
928	0	0.2126	0	Picric Acid

Data are also given for the distribution of β naphthol between water and benzene. The mean of the conc. in C_6H_6 layer divided by conc. in H_2O layer is given as 67. The temperature is not given. The determination of the β naphthol was made by an iodine titration method.

The coefficient of distribution of β naphthol between H_2O and $CHCl_3$ at 25° is; conc. in H_2O ÷ conc. in $CHCl_3$ = 0.0171. (Marden, 1914.)

Data for the solubility of β naphthol, picric acid (naphthol picrate) and their mixtures in benzene, determined by the synthetic (sealed tube) method, are given by Kuriloff (1897a).

100 cc. 90% alcohol dissolve about 55 gms. β $C_{10}H_7OH$ at 15.5°. (Greenish and Smith, 1903.)

100 gms. 95% formic acid dissolve 3.11 gms. β $C_{10}H_7OH$ at 18.6°. (Aschan, 1913.)

SOLIDIFICATION TEMPERATURES OF MIXTURES OF β NAPHTHOL AND SALOL.
(Bellucci, 1912.)

t° of Solidification.	Gms β $C_{10}H_7OH$ per 100 Gms. Mixture.	t° of Solidification.	Gms. β $C_{10}H_7OH$ per 100 Gms. Mixture.
121.7	100	80	40
116.5	90	68	30
111	80	52.5	20
105	70	34 Eutec.	10
97.5	60	38.5	5
88	50	42	0

FREEZING-POINT DATA (Solubility, see footnote, p. 1) ARE GIVEN FOR THE FOLLOWING MIXTURES:

α Naphthol	+ α Naphthylamine.	(Vignon, 1891.)
"	+ β "	"
"	+ Dimethylpyrone.	(Kendall, 1914.)
"	+ Resorcinol.	(Vignon, 1891)
"	+ *p* Toluidine.	(Vignon, 1891; Philip, 1903)
β Naphthol	+ α Naphthol.	(Vignon, 1891; Crompton and Whiteley, 1895.)
"	+ α Naphthylamine	(Vignon, 1891.)
"	+ β "	"
"	+ Dimethylpyrone	(Kendall, 1914.)
"	+ Picric Acid.	(Kendall, 1916.)
"	+ Sulfonal	(Bianchini, 1914.)
"	+ *p* Toluidine.	(Vignon, 1891)

α NAPHTHYLAMINE *p* Sulfonic Acid, 1.4 α $C_{10}H_6NH_2.SO_3H$.

α NAPHTHYLAMINE *o* Sulfonic Acid, 1.2 α $C_{10}H_6NH_2.SO_3H$.

SOLUBILITY OF EACH SEPARATELY IN WATER.
(Dolinski, 1905.)

t°.	Gms. per 100 Gms. H_2O. *p* Sulphonic Ac.	*o* Sulphonic Ac.	t°.	Gms. per 100 Gms. H_2O. *p* Sulphonic Ac.	*o* Sulphonic Ac.
0	0.027	0.24	50	0.059	0.81
10	0.029	0.32	60	0.075	1.01
20	0.031	0.41	70	0.097	1.37
30	0.037	0.52	80	0.130	1.80
40	0.048	0.65	90	0.175	2.40
			100	0.228	3.19

The coefficient of distribution of β naphthylamine between benzene and water at 25° is; conc. in $C_6H_6 \div$ conc. in H_2O = 279. The coefficient for α naphthylamine, similarly determined, is 252. (Farmer and Warth, 1904)

FREEZING-POINT DATA ARE GIVEN FOR THE FOLLOWING MIXTURES:

α Naphthylamine	+ Phenol.	(Philip, 1903)
"	+ Quinol.	(Philip & Smith, 1905.)
"	+ Resorcinol.	(" ; Vignon, 1891.)
"	+ *p* Toluidine.	(Vignon, 1891.)
β Naphthylamine	+ Phenol.	(Kremann, 1906)
"	+ Rescorcinol.	(Vignon, 1891.)
"	+ *p* Toluidine.	"

β NAPHTHYL BENZOATE $C_6H_5COOC_{10}H_7$.

100 gms. 95% formic acid dissolve 0.25 gm. $C_6H_5COOC_{10}H_7$ at 18.6°. (Aschan, 1913.)

NARCEINE $C_{23}H_{27}NO_8 + 3H_2O$.

100 gms. H_2O dissolve 0.078 gm. narceine at 13°; 100 gms. 80% alcohol dissolve 0.105 gm. at 13°.

100 gms. CCl_4 dissolve 0.011 gm. narceine at 17° (Schindelmeiser, 1901); 0.002 gm. at 20° (Gori, 1913).

NARCOTINE $C_{20}H_{23}NO_7$.

SOLUBILITY IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. Narcotine per 100 Gms. Solvent.	Authority.
Water	15	0 1*	(Guerin, 1913.)
Water	20	0.00445	(Zalai, 1910)
Acetone	15	41.96*	(Guerin, 1913)
Aq. 50 Vol. % Acetone	15	0.7*	"
Aniline	20	25	(Scholtz, 1912.)
Pyridine	20	2.3	"
Piperidine	20	1.7	"
Diethylamine	20	0.4	"
Carbon Tetrachloride	20	1.04	(Gori, 1913.)
Trichlor Ethylene	15	6.5	(Wester and Bruins, 1914)
Oil of Sesame	20	0.086	(Zalai, 1910.)

* Per 100 cc solvent.

NEODYMIUM CHLORIDE $NdCl.6H_2O$.

SOLUBILITY IN WATER. (Matignon, 1906, 1909.)

Method of obtaining saturation not stated.

t°.	d_{15} of Sat. Sol.	Gms $NdCl_3$ per 100 Gms. Sat. Sol.	Gms $NdCl_3$ per 100 Gms. Water.	Gms $NdCl_3.6H_2O$ per 100 Gms. Sat. Sol	Gms $NdCl_3.6H_2O$ per 100 Gms. Water.
13	1.74	49.67	98.68	71.12	246.2
100	...	...	140	...	...

100 gms. abs. alcohol dissolve 44.5 gms. (anhydrous) $NdCl_3$ at 20°. Saturation was obtained by spontaneous evaporation of the solution over H_2SO_4. (Matignon, 1906)

100 gms. anhydrous pyridine dissolve 1.8 gms. anhydrous $NdCl_3$ at about 15°. Saturation obtained by daily agitation of the solution for some weeks. (Matignon, '06)

NEODYMIUM COBALTICYANIDE $Nd_2(CoC_6N_6)_2.9H_2O$.

1000 gms. aq. 10% HCl ($d_{15} = 1.05$) dissolve 4.19 gms. salt at 25°. (James & Willand, '16)

NEODYMIUM GLYCOLATE $Nd(C_2H_3O_3)_3$.

One liter H_2O dissolves 4.609 gms. salt at 20°. (Jantsch & Grunkraut, 1912–13.)

NEODYMIUM MOLYBDATE $Nd_2(MoO_4)_3$.

One liter H_2O dissolves 0.0186 gm. salt at 28° and 0.0308 gm. at 75°. The mixtures were frequently stirred at constant temperature during only two hours. (Hitchcock, 1895.)

NEODYMIUM Double **NITRATES.**

SOLUBILITY IN AQ. HNO_3 OF $d_{16} = 1.325$ (= 51.59 GMS. HNO_3 PER 100 CC.) AT 16°. (Jantsch, 1912)

Double Salt.	Formula.	Gms. Hydrated Double Salt per 100 Gms. Sat. Sol.
Neodymium Magnesium Nitrate	$[Nd(NO_3)_6]_2Mg_3.24H_2O$	97.7
" Nickel "	" Ni_3 "	116.6
" Cobalt "	" CO_3 "	151.6
" Zinc "	" Zn_3 "	177
" Manganese "	" Mn_3 "	296

NEODYMIUM OXALATE $Nd_2(C_2O_4)_3.10H_2O$.

SOLUBILITY IN WATER AT 25° BY ELECTROLYTIC DETERMINATION. (Rimbach and Schubert, 1909.)

One liter sat. solution contains 0.0053 mg. equivalents of anhydrous salt = 0.49 milligram.

SOLUBILITY IN AQUEOUS 20% SOLUTIONS OF METHYL, ETHYL AND TRIETHYL AMINE OXALATES, ROUGHLY DETERMINED. (Grant and James, 1917.)

100 cc. aq. 20% methyl amine oxalate dissolve 0.027 gm. neodymium oxalate.
" " ethyl " " " 0.107 " " "
" " triethyl " " " 0.065 " " "

SOLUBILITY OF NEODYMIUM OXALATE IN AQUEOUS SOLUTIONS OF NEODYMIUM NITRATE AT 25°. (James and Robinson, 1913.)

(The mixtures were constantly agitated at constant temperature for twelve weeks.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$Nd_2(C_2O_4)_3$.	$Nd_2(NO_3)_6$.		$Nd_2(C_2O_4)_3$.	$Nd_2(NO_3)_6$.	
0.18	6.46	$Nd_2(C_2O_4)_3.11H_2O$	2.07	47.64	$Nd_2(C_2O_4)_3.11H_2O$
0.54	12.23	"	2.54	50.52	"
0.76	17.78	"	2.89	52.82	"
0.85	22.67	"	3.17	54.67	"
0.96	27.43	"	2.21	56.48 probably	1.2½.24
1.28	31.36	"	1.44	59.68	$Nd_2(NO_3)_6(?H_2O)$
1.38	35.26	"	1.33	59.67	"
1.66	38.70	"	1.21	59.70	"
1.88	42.13	"	0.96	59.75	"
1.96	44.82	"	...	60.46	"

1.2½.24 = $Nd_2(C_2O_4)_3.2\frac{1}{2}Nd_2(NO_3)_6.24H_2O$.

NEODYMIUM Dimethyl **PHOSPHATE** $Nd_2[(CH_3)_2PO_4]_6$.

100 gms. H_2O dissolve 56.1 gms. $Nd_2[(CH_3)_2PO_4]_6$ at 25° and about 22.3 gms. at 95°. (Morgan and James, 1914.)

NEODYMIUM SULFATE $Nd_2(SO_4)_3$.

SOLUBILITY IN WATER.
(Muthmann and Rolig, 1898)

t°.	Gms. $Nd_2(SO_4)_3$ per 100 Gms. Solution.	Water.	t°.	Gms. $Nd_2(SO_4)_3$ per 100 Gms. Solution.	Water.
0	8.7	9.5	50	3.5	3.7
16	6.6	7.1	80	2.6	2.7
30	4.7	5	108	2.2	2.3

NEODYMIUM SULFONATES.

SOLUBILITY IN WATER.

Sulfonate.	Formula.	t°.	Gms Anhydrous Salt per 100 Gms. H_2O.	Authority.
Neodymium:				
m Nitrobenzene Sulfonate	$Nd[C_6H_4(NO_2)SO_3]_3.6H_2O$	15	46.1	(Holmberg, 1907.)
Bromo Sulfonate	$Nd[C_6H_3Br(1)NO_2(4)SO_3(3)]_3.8H_2O$	25	7.25	(Katz & James, 1913.)

NEODYMIUM TUNGSTATE $Nd_2(WO_4)_3$.

One liter H_2O dissolves 0.0190 gm. $Nd_2(WO_4)_3$ at 22°, 0.0168 gm. at 65° and 0.0152 gm. at 98°. The mixtures were not constantly agitated and only two hours were allowed for saturation. (Hitchcock, 1895.)

NEON Ne.

SOLUBILITY IN WATER.
(v. Antropoff, 1909-10)

t°.	0.	10.	20.	30.	40.	50.
Coef. of Absorption β	0.0114	0.0118	0.0147	0.0158	0.0203	0.0317

The results are in terms of the coefficient of absorption as defined by Bunsen (see p. 227) and modified by Kuenen, in respect to substitution of mass of H_2O for volume of H_2O in the formula Absorp. coef. Kuenen $= \frac{(w - v)\,760}{\text{mass of } H_2O \times P}$.

NEURINE PERCHLORATE $CH_2.CH.N(CH_3)_3OH\ HClO_4$.

100 gms. H_2O dissolve 4.89 gms. of the salt at 14.5° (Hofmann & Höbold, 1911.)

NICKEL BROMATE $Ni(BrO_3)_2.6H_2O$.

100 gms. cold water dissolve 27.6 gms. nickel bromate.

NICKEL BROMIDE $NiBr_2.6H_2O$.

SOLUBILITY IN WATER.
(Etard, 1894.)

t°.	Gms. $NiBr_2$ per 100 Gms. Solution.	t°.	Gms. $NiBr_2$ per 100 Gms. Solution.	t°.	Gms. $NiBr_2$ per 100 Gms. Solution.
−20	47.7	25	57.3	80	60.6
−10	50.5	30	58	100	60.8
0	53	40	59.1	120	60.9
+10	55	50	60	140	61
20	56.7	60	60.4		

NICKEL CARBONATE $NiCO_3$.

One liter H_2O dissolves 7.789×10^{-4} mols. $NiCO_3$ = 0.0925 gm. at 25°. (Ageno and Valla, 1911.)

NICKEL CARBOXYL.

100 gms. of the aqueous solution saturated at 9.8° contain 2.36 cc. of the vapor = 6.43 milligrams Ni. In blood serum it is $2\frac{1}{2}$ times as soluble. (Armit, 1907.)

NICKEL CHLORATE $Ni(ClO_3)_2$.

SOLUBILITY IN WATER.
(Meusser — Ber. 35, 1419, '02.)

t°.	Gms. $Ni(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Ni(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Ni(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Ni(ClO_3)_2$ per 100 Mols H_2O.	Solid Phase.
−18	49 55	7.84	$Ni(ClO_3)_2.6H_2O$	48	67.60	16.65	$Ni(ClO_3)_2.4H_2O$
− 8	51 52	8.49	"	55	68.78	17.59	"
0	52.66	8.88	"	65	69.05	18.01	"
+18	56.74	10.47	"	79.5	75.50	24.68	"
40	64.47	15.35	"	−13.5	31.85	3.73	Ice
				− 9	26 62	2.90	"

Sp. Gr. of solution saturated at + 18 = 1.661.

According to Carlson (1910) 100 gms. sat. sol. in H_2O at 16° contain 64.1 gms. $Ni(ClO_3)_2$ and d_{16} of sat. sol. = 1.76.

NICKEL PerCHLORATE $Ni(ClO_4)_2.9H_2O$.

SOLUBILITY IN WATER.
(Goldblum and Terlikowski, 1912.)

t°.	d of Sat. Sol.	Gms. $Ni(ClO_4)_2$ per 100 Gms. H_2O.	Solid Phase.	t°.	d of Sat. Sol.	Gms. $Ni(ClO_4)_2$ per 100 Gms. H_2O.	Solid Phase.
0	...	0	Ice	−21.3	...	92.5	$Ni(ClO_4)_2.9H_2O$
−10.9	...	33.19	"	0	1.573	104.6	$Ni(ClO_4)_2.5H_2O$
−21.3	...	46.68	"	7.5	1.576	106.8	$Ni(ClO_4)_2.5H_2O$
−30.7	...	70	"	18	1.576	110.1	"
−49	...	...	Ice + $Ni(ClO_4)_2.9H_2O$	26	1.584	112.2	"
−30.7	...	90	$Ni(ClO_4)_2.9H_2O$	45	1.594	118.6	"

NICKEL CHLORIDE $NiCl_2.6H_2O$.

SOLUBILITY IN WATER.

(Etard, 1894)

t°.	Gms. $NiCl_2$ per 100 Gms. Solution.	t°.	Gms. $NiCl_2$ per 100 Gms. Solution.	t°.	Gms. $NiCl_2$ per 100 Gms. Solution.
−17	29.7	25	40	60	45.1
0	35	30	40.8	70	46
+10	37.3	40	42.3	78	46.6
20	39.1	50	43.9	100	46.7

1000 cc. sat. HCl solution dissolve 4 gms. $NiCl_2$ at 12°. (Ditte, 1881.)
100 gms. abs. alcohol dissolve 10.05 gms. $NiCl_2$ at room temperature.
100 gms. abs. alcohol dissolve 53.71 gms. $NiCl_2.6H_2O$ at room temperature. (Bodtker, 1897.)
100 gms. abs. alcohol dissolve 2.16 gms. $NiCl_2.7H_2O$ at 17°, and 1.4 gms. at 3°. (de Bruyn, 1892)
100 gms. saturated solution in glycol contain 16.2 gms. $NiCl_2$ at room temperature. (de Coninck, 1905.)
100 cc. anhydrous hydrazine dissolve 8 gms. $NiCl_2$ at room temp. and solution is colored violet. (Welsh and Broderson, 1915.)
100 gms. 95% formic acid dissolve 5.9 gms. $NiCl_2$ at 20.5°. (Aschan, 1913)
When 1 gm. of nickel, as chloride, is dissolved in 100 cc. of 10% aq. HCl and shaken with 100 cc. of ether, 0.01 per cent of the Nickel enters the ethereal layer. (Mylius, 1911.)

NICKEL CITRATE $Ni_3[(COOCH_2)_2C(OH)COO]_2.2H_2O$.

100 cc. sat. solution in water contain 0.28 gm. Ni = 0.94 gm. anhydrous salt at 10°. (Pickering, 1915)

NICKEL Potassium **CITRATE** $K_4Ni[(COOCH_2)_2COHCOO]_2$.

100 cc. sat. sol. in water contain 3.9 gms. Ni = 41 gms. salt at 10°. (Pickering, 1915.)

NICKEL HYDROXIDE $Ni(OH)_2$.

Aqueous ammonia solutions of nickel hydroxide were evaporated in a vacuum desiccator and samples withdrawn at intervals for analysis. The results obtained in duplicate series yielded different curves. For 2 *n* NH_3 the gms. Ni per liter varied from 0.17 to 0.83. For 4 *n* NH_3, the gms. Ni per liter varied from 0.36 to 1.8. (Bonsdorff, 1904.)

NICKEL IODATE $Ni(IO_3)_2$.

SOLUBILITY IN WATER.

(Meusser — Ber. 34, 2440, '01.)

t°.	Gms. $Ni(IO_3)_2$ per 100 Gms. Solution.	Mols. $Ni(IO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Ni(IO_3)_2$ per 100 Gms. Solution.	Mols. $Ni(IO_3)_2$ per 100 Mols. H_2O.	Solid Phase.
0	0.73	0.033	$Ni(IO_3)_2.4H_2O$	18	0.55	0.0245	$Ni(IO_3)_2.2H_2O$ (2)
18	1.01	0.045	"	50	0.81	0.035	"
30	1.41	0.063	"	75	1.03	0.045	"
0	0.53	0.023	$Ni(IO_3)_2.2H_2O$ (1)	80	1.12	0.049	"
18	0.68	0.030	"	30	1.135	0.050	$Ni(IO_3)_2$
30	0.86	0.039	"	50	1.07	0.046	"
50	1.78	0.080	"	75	1.02	0.045	"
8	0.52	0.023	$Ni(IO_3)_2.2H_2O$ (2)	90	0.988	0.044	"

(1) α Dihydrate. (2) β Dihydrate.

NICKEL IODIDE $NiI_2.6H_2O$.

SOLUBILITY IN WATER. (Etard, 1894.)

t°.	Gms. NiI_2 per 100 Gms. Solution	t°.	Gms. NiI_2 per 100 Gms. Solution.	t°.	Gms. NiI_2 per 100 Gms Solution.
−20	52	25	60.7	60	64.8
0	55.4	30	61.7	70	65
10	57.5	40	63.5	80	65.2
20	59.7	50	64.7	90	65.3

By interpolation the tr. pt. for $NiI_2.6H_2O + NiI_2.4H_2O$ is at 43°.

NICKEL MALATE $Ni[CH_2CHOH(COO)]_2.3H_2O$.

100 cc. sat. solution in water contain 0.02 gm. Ni = 0.06 gm. salt at 10°. (Pickering, 1915.)

NICKEL NITRATE $Ni(NO_3)_2$.

SOLUBILITY IN WATER.

(Funk — Wiss. Abh. p. t. Reichanstalt, 3, 439, '00)

t°.	Gms. $Ni(NO_3)_2$ per 100 Gms. Solution.	Mols. $Ni(NO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Ni(NO_3)_2$ per 100 Gms. Solution.	Mols. $Ni(NO_3)_2$ per 100 Mols. H_2O.	Solid Phase.
−23	39.02	6.31	$Ni(NO_3)_2.9H_2O$	20	49.06	9.49	$Ni(NO_3)_2.6H_2O$
−21	39.48	6.43	"	41	55.22	12.1	"
−10.5	44.13	7.79	"	56.7	62.76	16.7	"
−21	39.94	6.55	$Ni(NO_3)_2.6H_2O$	58	61.61	15.9	$Ni(NO_3)_2.3H_2O$
−12.5	41.59	7.01	"	60	61.99	16.0	"
−10	42.11	7.16	"	64	62.76	16.6	"
−6	43.00	7.44	"	70	63.95	17.6	"
0	44.32	7.86	"	90	70.16	23.1	"
+18	48.59	9.3	"	95	77.12	33.3	"

100 gms. sat. solution in glycol contain 7.5 gms. $Ni(NO_3)_2$ at room temperature. (de Coninck)

100 cc. anhydrous hydrazine dissolve 3 gms. $Ni(NO_3)_2$ at room temp. (Welsh and Broderson, 1915)

NICKEL OXALATE $Ni(COO)_2$.

100 gms. 95% formic acid dissolve 0.01 gm. at 19.8°. (Aschan, 1913.)

NICKEL SULFATE $NiSO_4.7H_2O$.

SOLUBILITY IN WATER. (Steele and Johnson, 1904; see also Tobler, Etard and Mulder)

t°.	Grams $NiSO_4$ per 100 Gms Solution.	Water.	Solid Phase.	t°.	Grams $NiSO_4$ per 100 Gms Solution.	Water.	Solid Phase.
−5	20.47	25.74	$NiSO_4.7H_2O$	33.0	30.25	43.35	$NiSO_4.6H_2O$
0	21.40	27.22	"	35.6	30.45	43.79	" (blue)
9	23.99	31.55	"	44.7	32.45	48.05	"
22.6	27.48	37.90	"	50.0	33.39	50.15	"
30	29.99	42.46	"	53.0	34.38	52.34	"
32.3	30.57	44.02	"	54.5	34.43	52.50	$NiSO_4.6H_2O$
33	31.38	45.74	"	57.0	34.81	53.40	" (green)
34	31.20	45.5	"	60	35.43	54.80	"
32.3	30.35	43.57	$NiSO_4.6H_2O$	70	37.29	59.44	"
33.0	30.25	43.35	" (blue)	80	38.71	63.17	"
34.0	30.49	43.83	"	99	43.42	76.71	"

Transition points, hepta hydrate ⇄ hexa hydrate = 31.5°.
Hexa hydrate (blue) ⇄ hexa hydrate (green) = 53.3°.

SOLUBILITY OF MIXTURES OF NICKEL SULPHATE AND COPPER SULPHATE.

(Fock — Z. Kryst. Min. 28, 387, '97.)

Results at 35°.

Gms. per 100 Gms. H_2O.		Mol. per cent in Solution.		Mol. per cent in Solid Phase.		Crystal Form.
$CuSO_4$.	$NiSO_4$.	$CuSO_4$.	$NiSO_4$.	$CuSO_4$.	$NiSO_4$.	
9.62	583.9	1.57	98.43	0.35	99.65	Rhombic
41.66	484.4	7.69	92.31	2.12	97.88	"
75.39	553.5	11.66	88.34	4.77	95.23	Tetragonal
106.40	506.5	16.92	83.08	6.52	93.48	"
172.0	483.8	25.63	74.37	13.88	86.17	"
186.9	468.0	27.90	72.10	18.77	81.23	Tetragonal
				94.91	5.09	Triclinic

Results at 67°.

Gms. per 100 Gms. H_2O.		Mol. per cent in Solution.		Mol. per cent in Solid Phase.		Crystal Form.
$CuSO_4$.	$NiSO_4$.	$CuSO_4$.	$NiSO_4$.	$CuSO_4$.	$NiSO_4$.	
20.04	729.3	2.65	97.35	0.93	99.07	Monoclinic
66.01	706.2	8.31	91.69	2.86	97.14	"
88.08	501.6	13.55	86.45	3.92	96.08	"
47.94	675.0	16.39	83.61	6.66	93.34	"
249.9	747.8	24.46	75.54	22.32	77.68	Monoclinic, Triclinic

SOLUBILITY OF MIXTURES OF NICKEL SULPHATE AND SODIUM SULPHATE, ETC.

(Koppel; Wetzel — Z. physik. Chem. 52, 401, '05.)

t°.	Gms. per 100 Gms Solution.		Gms. per 100 Gms. H_2O.		Mols. per 100 Mols. H_2O.		Solid Phase.
	$NiSO_4$.	Na_2SO_4.	$NiSO_4$.	Na_2SO_4.	$NiSO_4$.	Na_2SO_4.	
0	16.94	7.61	22.46	10.09	2.61	1.28	$NiSO_4.7H_2O + Na_2SO_4.10H_2O$
5	17.99	10.85	25.28	15.24	2.94	1.93	"
10	18.97	13.85	28.26	20.64	3.29	2.61	"
20	18.76	17.21	29.31	26.87	3.410	3.404	$NiNa_2(SO_4)_2.4H_2O$
25	17.85	16.54	27.33	25.33	3.181	3.208	"
30	16.74	15.34	24.64	22.58	2.868	2.861	"
35	16.28	14.91	23.66	21.67	2.753	2.744	"
40	15.35	14.49	21.88	20.65	2.546	2.616	"
18.5	19.61	16.49	30.70	25.80	3.56	3.27	$NiNa_2(SO_4)_2.4H_2O + NiSO_4.7H_2O$
20	20.13	16.15	31.59	25.35	3.67	3.21	"
25	21.20	14.77	33.11	23.06	3.85	2.92	"
30	22.60	12.80	34.98	19.82	4.07	2.59	"
35	23.62	10.78	36.01	16.43	4.19	2.08	"
40	24.92	9.39	37.93	14.29	4.41	1.81	"
18.5	16.80	18.93	26.14	29.45	3.04	3.72	$NiNa_2(SO_4)_2.4H_2O + Na_2SO_4.10H_2O$
20	15.48	20.18	24.06	31.37	2.80	3.97	"
25	10.92	24.12	16.81	37.13	1.96	4.70	"
30	6.40	28.71	9.87	44.25	1.15	5.60	"
35	4.54	31.65	7.13	49.59	0.838	6.28	$NiNa_2(SO_4)_2.4H_2O + Na_2SO_4$
40	4.63	31.37	7.24	49.03	0.843	6.21	"

Solubility of Nickel Potassium Sulfate $NiK_2(SO_4)_2.6H_2O$ in Water.

(Tobler, 1855; v. Hauer, 1858.)

t°.	Gms. $NiK_2(SO_4)_2$ per 100 Gms. H_2O. (Tobler.)	(v. Hauer.)	t°.	Gms. $NiK_2(SO_4)_2$ per 100 Gms. H_2O. (Tobler.)	(v. Hauer.)
0	5.3	...	50	30	...
10	8.9	...	60	35.4	20.47
20	13.8	9.53	70	42	...
30	18.6	...	80	46	28.2
40	24	14.03			

Solubility of Nickel Sulfate in Aqueous Solutions of Methyl Alcohol at 14°.

(de Bruyn, 1903.)

Small test tubes of 4–6 cc. capacity were used. They were almost completely filled with the salt and solvent and placed in the bath in an inclined position with salt occupying the upper part of the tube. This caused a "spontaneous circulation of the solvent." The solutions were analyzed by precipitating NiO with KOH at the boiling point, in porcelain vessels.

Wt. Per cent CH_3OH in Solvent.	Gms $NiSO_4$ per 100 Gms Sat. Sol. in Contact with: $NiSO_4.7H_2O$ as Solid Phase.	$NiSO_4.6H_2O$ α as Solid Phase.	$NiSO_4.6H_2O$ β as Solid Phase.	$NiSO_4.4H_2O$ as Solid Phase.
0 (H_2O)	26.4	26 (low)	27.2	25.1
10	19.7	22 (?)	20.4	...
20	13.1	14.7	14	14.8
30	6.8	6.6	7.5	...
40	2.8	2.4	3.1	...
50	1.3	1	1.4	1.4
60	0.8	0.4	0.6	...
70	0.6	0.2	0.4	...
80	0.65	0.2	0.4	0.66
85	1.5	0.3	0.7	...
90	5.7	1.2	2.5	...
95	11	6	9 (?)	...
100	16.8	12.4 (low)	15.7 (low)	7.38

$NiSO_4.6H_2O$ α is greenish blue. $NiSO_4.6H_2O$ is more greenish than the α salt.

Solubility of $NiSO_4.3CH_3OH.3H_2O$ in Aqueous CH_3OH at 14°.

(de Bruyn, 1903)

Wt. Per cent CH_3OH.	Gms $NiSO_4$ per 100 Gms Sat Sol.	Wt Per cent CH_3OH	Gms. $NiSO_4$ per 100 Gms Sat. Sol.
85	1.93	90	0.70
86	1.73	92.5	0.50
87	1.48	95	0.455
88	1.25	97.5	0.77
89	1.01	100	3 72

Approximately two hours were allowed for attainment of equilibrium.

In solutions containing more than 15% H_2O the salt is gradually transformed to $NiSO_4.6H_2O$ β.

100 gms. absolute ethyl alcohol dissolve 1.4 gm. $NiSO_4.7H_2O$ at 4° and 2.2 gms. at 17°. (de Bruyn, 1892.)

100 gms. sat. solution in glycol contain 9.7 gms. $NiSO_4$ at room temp. (de Coninck, 1905.)

NICKEL SULFIDE NiS.

One liter H_2O dissolves 39.9×10^{-6} gm. mols. NiS = 0.0036 gm. at 18°, by conductivity method. (Weigel, 1906.)

Fusion-point data for Ni_2S+Na_2S and $Ni_3S_2+Na_2S$ are given by Friedrich (1914).

NICOTINE $C_{10}H_{14}N_2$.

SOLUBILITY IN WATER.

(Hudson, 1904.)

Determinations made by Synthetic Method, for which see Note, page 16. Below 60° and above 210° both liquids are miscible in all proportions; likewise with percentages of nicotine less than 6.8 and above 82 per cent the liquid does not show two layers at any temperature. Below 94° the upper layer is water. Above 94° the upper layer is nicotine. The curve plotted from the following results makes a complete circle.

Percentage of Nicotine in the Mixture.	Temperature of Appearance of Two Layers. Degrees C.	Temperature of Homogeneity. Degrees C.
6.8	94	95
7.8	89	155
10.0	75	...
14.8	65	200
32.2	61	210
49.0	64	205
66.8	72	190
80.2	87	170
82.0	129	130

Additional data for the above system are given by Tsakalotos (1909). The values for the temperatures of saturation are in general, from 1° to 5° lower than those of Hudson.

NIOBIUM Potassium FLUORIDE NbK_2F_7.

SOLUBILITY IN WATER AND IN AQUEOUS HF AND AQUEOUS KF SOLUTIONS.

(Ruff and Schiller, 1911)

The determinations were made in platinum vessels. The mixtures were shaken for 3 hour periods at constant temperature and the saturated solutions filtered through platinum funnels.

Solvent.	t°.	Gms. per 100 Gms. Sat Solution. NbF_5.	KF	HF.	Solid Phase.
Water	16	5.19	2.98	0.35	$K_2NbOF_5.H_2O$
"	16	7.07	5.33	4.35	$K_2NbOF_5.H_2O+K_2NbF_7$
Aq. 10.95% HF	16	4.33	2.32	10.43	K_2NbF_7
" 7.41% KF	16	1.16	5.54	0.13	$K_2NbOF_5.H_2O$
" 7.39% KF	16	2.67	6.04	5.39	$K_2NbOF_5.H_2O+K_2NbF_7$
Water	85	30.39	14.68	0.35	$K_2NbOF_5.H_2O$(?)
Aq. 4.81% KF	80	11.66	10.08	1.53	"

NITRIC ACID HNO_3.

DISTRIBUTION OF NITRIC ACID BETWEEN WATER AND ETHER AT 25°.

(Bogdan, 1905, 1906)

Mols. HNO_3 per Liter of: H_2O Layer.	Ether Layer.	Mols. HNO_3 per Liter of: H_2O Layer.	Ether Layer.
0.9145	0.0855	0.09005	0.00181
0.4811	0.0278	0.04749	0.00064
0.2644	0.00894	0.02760	0.00029
0.1392	0.00278	0.02462	0.00025

Reciprocal Solubility of Nitric Acid and Water, Determined by the Freezing-point Method.

(Küster and Kremann, 1904; see also Pickering, 1893)

t°.	Gms. HNO_3 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. HNO_3 per 100 Gms. Sat. Sol.	Solid Phase.
−10	13.9	Ice	−40	69.7	$HNO_3.3H_2O$
−20	22.9	"	−42 Eutec.	70.5	" $+HNO_3.H_2O$
−30	27.8	"	−40	72.5	$HNO_3.H_2O$
−40	31.5	"	−38 m. pt.	77.75	"
−43 Eutec.	32.7	" $+HNO_3.3H_2O$	−40	82.4	"
−40	34.1	$HNO_3.3H_2O$	−50	86.5	"
−30	40	"	−60	88.8	"
−20	49.2	"	−66.3 Eutec.	89.95	" $+HNO_3$
−18.5 m. pt.	53.8	"	−60	91.9	HNO_3
−20	58.5	"	−50	94.8	"
−30	65.4	"	−41.2 m. pt.	100	"

NITROGEN N_2.

Solubility in Water.

(Winkler — Ber. 24, 3606, '91; Braun — Z. physik. Chem. 33, 732, '00; Bohr and Bock — Wied. Ann. 44, 318, '91.)

t°	"Coefficient of Absorption" β.			"Solubility" B′.	q.
0	0.0235*	0.0239†	...‡	0.0233*	0.00239*
5	0.0208	0 0215	0 0217	0.0206	0.00259
10	0.0186	0 0196	0.0200	0.0183	0 00230
15	0.0168	0 0179	0 0179	0 0165	0.00208
20	0.0154	0 0164	0.0162	0.0151	0 00189
25	0.0143	0.0150	0.0143	0.0139	0 00174
30	0.0134	0.0138	...	0.0128	0.00161
35	0 0125	0.0127	...	0 0118	0.00148
40	0.0118	0.0118	...	0.0110	0.00139
50	0 0109	0.0106	...	0 0096	0 00121
60	0.0102	0.0100	...	0.0082	0 00105
80	0.0096	...	...	0 0051	0.00069
100	0.0095	0.0100	...	0.0000	0.00000

* W. † B. and B. ‡ B.

For values of β, β′, and q, see Ethane, p. 285.

Single determinations of the solubility of nitrogen in water reported by Hüfner (1906–07), Bohr (1910), Müller (1912–13) and von Hammel (1915), are, on the average, about 2–3 units in the fourth place higher than the above figures of Winkler for the absorption coefficient β. Drucker and Moles (1910), give an extensive review of the literature and present results which, they state, are in very satisfactory agreement with previous determinations. A critical review of the literature of the solubility of nitrogen in water and in sea water is given by Coste (1917).

Data for the solubility of the nitrogen of air in water are given by Fox (1909a). The oxygen was removed from air and the solubility of the residual N + 1.185% argon was determined. After making correction for the argon, the following formula for the solubility of pure nitrogen in water was deduced:

$$1000 \times \text{coef. of abs. } \beta = 22.998 - 0.5298\,t + 0.009196\,t^2 - 0.00006779\,t^3.$$

Data for the solubility of nitrogen in water at pressures up to 10 atmospheres are given by Cassuto (1913). The solubility was found to increase at a somewhat slower rate than proportional to the pressure.

Solubility of Nitrogen in Sea Water.

(Fox, 1909a).

Before using the sample of sea water for the solubility determinations it was found necessary to add acid, otherwise the CO_2 could not be boiled out or the precipitation of neutral carbonates prevented. The very small amount of acid was titrated back, using phenolphthaleine as indicator.

The results are in terms of number of cc. of nitrogen (containing argon) absorbed by 1000 cc. of sea water from a free dry atmosphere of 760 mm. pressure.

The calculated formula expressing the solubility is:

$$1000\,a = 18.639 - 0.4304\,t + 0.007453\,t^2 - 0.0000549\,t^3 - Cl\,(0.2172 - 0.007187\,t + 0.0000952\,t^2).$$

Parts Chlorine per 1000.	$t°=0°$.	4°.	8°.	12°.	16°.	20°.	24°.	28°.
0	18.64	17.02	15.63	14.45	13.45	12.59	11.86	11.25
4	17.74	16.27	14.98	13.88	12.94	12.15	11.46	10.89
8	16.90	15.51	14.32	13.30	12.44	11.70	11.07	10.52
12	16.03	14.75	13.66	12.72	11.93	11.25	10.67	10.16
16	15 18	14	13	12.15	11.73	10.81	10.27	9.80
20	14.31	13.27	12.34	11.57	10.92	10.36	9.87	9.44

A recalculation of Fox's determinations to parts per million, with correction for vapor pressure, is published by Whipple and Whipple (1911).

Solubility of Nitrogen in Aqueous Solutions of Sulfuric Acid

Results at 21°. (Bohr, 1910.)				Results at 20°. (Christoff, 1906.)	
Normality of Aq. H_2SO_4.	Absorption Coef. β (Bunsen).	Normality of Aq. H_2SO_4.	Absorp. Coef. β (Bunsen).	Per cent H_2SO_4.	Ostwald Solubility Expression l_{20}.
0	0.0156	24.8	0 0048	0	0.01537
4.9	0.0091	29.6	0.0051	35 82	0.008447
8.9	0.0072	34.3	0.0100	61.62	0.006144
10.7	0.0066	35.8*	0.0129	95.6	0.01672
20.3	0.0049				

* = about 96%.

For definitions of Absorption Coef. (Bunsen) and Solubility Expression (Ostwald), see p. 227.

Solubility of Nitrogen in Aqueous Salt Solutions.

(Braun)

t°.	Coefficient of Absorption of N in Barium Chloride Solutions of: 13.83 Per cent	11 92 Per cent.	6 90 Per cent.	3.87 Per cent.	3.33 Per cent.
5	0.0127	0.0137	0.0160	0.0180	0.0183
10	0 0117	0 0125	0.0147	0.0166	0.0168
15	0.0104	0.0114	0.0132	0.0148	0.0150
20	0.0092	0.0098	0.0118	0.0132	0.0135
25	0.0078	0.0086	0.0104	0.0114	0.0119

t°.	Coefficient of Absorption of N in Sodium Chloride Solutions of: 11.73 Per cent.	8.14 Per cent.	6 4 Per cent.	2 12 Per cent.	0.67 Per cent.
5	0.0102	0.0127	0.0138	0.0179	0.0200
10	0.0093	0.0113	0.0126	0.0164	0.0185
15	0.0081	0 0101	0.0113	0.0147	0.0164
20	0.0066	0.0087	0.0098	0.0131	0.0148
25	0.0047	0.0075	0.0083	0.0113	0.0130

Solubility of Nitrogen in Alcohol.

(Bunsen.)

t°.	0°.	5°.	10°.	15°.	20°.	24°.
Vols. N* dissolved by 1 Vol. Alcohol.	0.1263	0.1244	0.1228	0.1214	0.1204	0.1198

* At 0° and 760 mm.

Solubility of Nitrogen in Mixtures of Ethyl Alcohol and Water at 25°.

(Just, 1901.)

Results in terms of the Ostwald solubility expression, see p. 227.

Vol % H_2O in Mixture.	Vol. % Alcohol in Mixture.	Dissolved N (l_{25}).
100	0	0.01634
80	20	0.01536
67	33	0.01719
0	100 (99.8% Alcohol)	0.1432

Solubility of Nitrogen in Several Solvents at 20° and 25°.

(Just)

Solvent.	l_{25}	l_{20}.	Solvent.	l_{25}	l_{20}.
Water	0.01634	0 01705	Toluene	0.1235	0 1186
Aniline	0.03074	0 02992	Chloroform	0.1348	0.1282
Carbon Disulfide	0.05860	0.05290	Methyl Alcohol	0 1415	0 1348
Nitro Benzene	0.06255	0 06082	Ethyl Alcohol (99 8%)	0.1432	0 1400
Benzene	0.1159	0 1114	Acetone	0 1460	0 1383
Acetic Acid	0 1190	0 1172	Amyl Acetate	0.1542	0.1512
Xylene	0 1217	0 1185	Ethyl Acetate	0 1727	0 1678
Amyl Alcohol	0.1225	0.1208	Isobutyl Acetate	0.1734	0 1701

Solubility of Nitrogen in Petroleum. Coefficient of Absorption at 10° = 0.135, at 20° = 0.117.

(Gniewasz and Walfisz, 1887)

Solubility of Nitrogen in Aqueous Propionic Acid and Urea Solutions.

(Braun)

t°.	Coefficient of Absorption of N in C_2H_5COOH Solutions of				
	11.22 per cent	9 54 per cent	6 07 per cent	4 08 per cent.	3 82 per cent.
5	0.0195	0.0204	0 0208	0 0210	0.0209
10	0.0178	0.0182	0.0186	0 0192	0.0191
15	0.0159	0.0163	0.0164	0.0169	0.0167
20	0.0146	0.0147	0.0148	0.0154	0 0155
25	0.0130	0.0134	0.0134	0.0137	0.0137

t°.	Coefficient of Absorption of N in $CO(NH_2)_2$ Solutions of.					
	15.65 per cent	11 9 per cent	9 42 per cent	6 90 per cent	5.15 per cent.	2.28 per cent.
5	0.0175	0.0179	0.0190	0.0198	0.0197	0.0199
10	0.0162	0.0167	0.0176	0 0183	0 0182	0.0184
15	0 0150	0.0149	0.0158	0.0165	0.0165	0.0171
20	0.0140	0.0139	0.0146	0.0151	0.0151	0.0155
25	0.0130	0.0130	0.0133	0.0137	0.0135	0.0139

SOLUBILITY OF NITROGEN IN AQUEOUS SOLUTIONS OF CHLORAL HYDRATE AT 15°.

Results by Müller, C (1912–13.)			Results by von Hammel (1915).		
Gms. $CCl_3.CH(OH)_2$ per 100 Gms. Aq. Sol.	d_{20} of Aq. Sol.	Absorp. Coef. β at 15°.	Gms. $CCl_3CH(OH)_2$ per 100 Gms. Aq. Sol.	Abs. Coef. β at 15°.	Solubility l_{25} (Ostwald).
0	1	0.0170	0	0.0170	0.01796
15.8	1.0738	0.0158	15	0.0152	0.0160
28.2	1.1422	0.01422	26.1	0.0141	0.0149
37.25	1.1946	0.01300	37.6	0.0123	0.0130
47	1.2535	0.01275	48.9	0.0115	0.0121
56.52	1.3225	0.01245	61.3	0.0114	0.0120
71.5	1.441	0.01420	70.9	0.0131	0.0138
78.8	1.503	0.01492	79.1	0.0156	0.0165

SOLUBILITY OF NITROGEN IN AQUEOUS SOLUTIONS OF GLYCEROL.

Results of Müller, C. (1912–13).			Results of von Hammel (1915).		Results of Drucker and Moles (1910).		
Gms. $(CH_2OH)_2$-CHOH per 100 Gms. Aq. Sol.	d_{16} of Aq. Sol.	Abs. Coef. β at 15°.	Gms. $(CH_2OH)_2$-CHOH per 100 Gms. Aq. Sol	Abs. Coef. β at 15°.	Gms. $(CH_2OH)_2$-CHOH per 100 Gms. Aq. Sol.	d_{25} of Aq. Sol.	Solubility l_{25} (Ostwald).
25	1.061	0.01266	15.7	0.01400	0	0	0.0156
42.2	1.108	0.00976	29.9	0.01087	16	1.0392	0.0103
51.5	1.133	0.00759	46.6	0.00840	29.7	1.0744	0.0067
58	1.151	0.00703	57.6	0.00698	48.9	1.1263	0.0052
80.25	1.212	0.00530	67.1	0.00635	74.5	1.1931	0.0025
90	1.240	0.00583	77	0.00527	84.1	1.2213	0.0024
95	1.249	0.00716	88.5	0.00536			
			99.25	0.00524			

Solubility of N_2 in pure isobutyric acid of d_{25} = 0.9481, l_{25} (Ostwald) = 0.1651. (Drucker and Moles, 1910.)

Solubility of N_2 in aq. 37.5% isobutyric acid of d_{25} = 0.9985, l_{22} (Ostwald) = 0.0396. (Drucker and Moles, 1910.)

Solubility of N_2 in aq. 37.5% isobutyric acid of d_{25} = 0.9985, l_{29} (Ostwald) = 0.0384. (Drucker and Moles, 1910.)

SOLUBILITY OF NITROGEN IN AQUEOUS SOLUTIONS OF SEVERAL COMPOUNDS.
(Hufner, 1906–07)

Aq. Solution of:	Conc. of Aq. Solution. Normality.	Gms. per Liter.	t°.	Abs. Coef. β.
Glucose	1	180	20.18	0.01215
"	0.5	90	20.21	0.01380
"	0.25	45	20.2	0.01480
Alanine (α Aminopropionic Acid)	1	89	20.19	0.01213
Glycocol (Aminoacetic Acid)	1	75	20.16	0.01212
Aribinose	1	150	20.21	0.01203
Levulose	1	180	20.25	0.01221
Erythritol	1	122	20.25	0.01321
Urea	1	60	20.18	0.01477
Acetamide	1	59	20.22	0.01475

SOLUBILITY OF NITROGEN IN AQUEOUS SOLUTIONS OF CANE SUGAR AT 15°.
(Müller, C., 1912–13)

Gms. $C_{12}H_{22}O_{11}$ per 100 Gms. Aq. Solution.	d_{16} of Aq. Sol.	Abs. Coef. β at 15°.	Gms. $C_{12}H_{22}O_{11}$ per 100 Gms. Aq. Solution.	d_{16} of Aq Sol.	Abs. Coef. β at 15°.
11.38	1.050	0.01480	30.12	1.129	0.01090
20	1.082	0.01280	47.89	1.220	0.00785
29.93	1.128	0.01053	48.57	1.223	0.00700

Data for the solubility of nitrogen in defibrinated ox-blood and ox serum under pressures varying 760–1400 mm. Hg are given by Findlay and Creighton (1910–11).

Data for the solubility of nitrogen in liquid oxygen are given by Erdman and Bedford (1904) and Stock (1904.)

SOLUBILITY OF NITROGEN IN METHYL ALCOHOL SOLUTIONS OF POTASSIUM IODIDE AND OF UREA.

(Levi, 1901.)

Solvent. Gms. KI or of Urea per 100 Gms. CH_3OH Solution.		Solubility of N (in terms of the Ostwald Solubility Expression l). At 5°.		At 15°.		At 25°.	
		d_5 of Solvent.	l_5.	d_{15} of Solvent.	l_{15}.	d_{25} of Solvent.	l_{25}.
0	(= pure CH_3OH)	0.8080	0.2154	0.7980	0.1923	0.7937	0.1649
2.152	KI	0.8171	0.2028	0.8070	0.1802	0.8019	0.1524
3.053	"	0.8249	0.1966	0.8015	0.1756	0.8101	0.1466
10.939	"	0.8930	0.1676	0.8841	0.1464	0.8801	0.1258
2.738	Urea	0.8148	0.2030	0.8050	0.1823	0.7997	0.1561
4.841	"	0.8231	0.1951	0.8122	0.1750	0.8080	0.1491
7.377	"	0.8350	0.1878	0.8241	0.1690	0.8193	0.1444

SOLUBILITY OF NITROGEN IN ETHYL ETHER.

(Christoff, 1912)

Results in terms of the Ostwald expression l (see p. 227), $l_0 = 0.2580$, $l_{10} = 0.2561$.

NITROGEN OXIDE (ic) NO.

SOLUBILITY IN WATER.

(Winkler, 1901)

t°.	β.	β'.	q.	t°.	β.	β'.	q.
0	0.0738	0.0734	0.00984	40	0.0351	0.0325	0.00440
5	0.0646	0.0641	0.00860	50	0.0315	0.0277	0.00376
10	0.0571	0.0564	0.00757	60	0.0295	0.0237	0.00324
15	0.0515	0.0506	0.00680	70	0.0281	0.0195	0.00267
20	0.0471	0.0460	0.00618	80	0.0270	0.0144	0.00199
25	0.0430	0.0419	0.00564	90	0.0265	0.0082	0.00114
30	0.0400	0.0384	0.00517	100	0.0263	0.0000	0.00000

For values of β, β' and q, see Ethane, page 285.

SOLUBILITY OF NITRIC OXIDE IN AQUEOUS SULPHURIC ACID SOLUTIONS AT 18°.

(Lunge, 1885, Tower, 1906)

Wt. per cent H_2SO_4 in Solution.	Sp. Gr. at 15°.	Tension of H_2O Vapor.	Solubility Coefficient * of NO at 18°.	
98	1.84	...	0.0227	(0.035, L.)
90	1.82	0 1 mm.	0.0193	
80	1.733	0.4 "	0.0117	
70	1.616	1.5 "	0.0113	
60	1.503	3.1 "	0.0118	(0.017, L.)
50	1.399	6 2 "	0.0120	

* Volume of NO (at 760 mm) per 1 volume of aqueous H_2SO_4.

SOLUBILITY OF NITRIC OXIDE IN ALCOHOL.

(Bunsen)

t°	0°	5°	10°	15°	20°	24°
Vols. NO* absorbed by 1 vol. Alc.	0.316	0.300	0.286	0.275	0.266	0.261

* At 0° and 760 mm.

Data for the solubility of nitric oxide in aqueous solutions of $FeSO_4$, $NiSO_4$, $CoSO_4$ and $MnCl_2$ at 20° are given by Usher (1908); Hüfner (1907) and Manchot and Zecheulmayer (1906).

The abs. coef. β for N in sat. aq. $NiSO_4$ at 20° is 0.0245; for sat. $CoSO_4$ it is 0.0288 and for sat. aq. $MnCl_2$ it is 0.0082.

NITROUS OXIDE N_2O.

SOLUBILITY IN WATER.

(Bunsen; Roth, 1897; Knopp, 1904; Geffcken, 1904.)

t°.	Coefficient of Absorption β (B.)	(R.)	q.	Solubility in Terms of Ostwald Expression (l).* (R.)	(K.)	(G.)
5	1.0954	1.1403	0.205	1.161	...	1.067
10	0.9196	0.9479	0.171	0.9815	...	0.9101
15	0.7778	0.7896	0.143	0.8315	...	0.7784
20	0.6700	0.6654	0.121	0.7131	0.6739	0.6756
25	0.5961	0.5752	0.104	0.6281	...	0.5942

* Calculated by Geffcken.

For definitions of β and q, see p. 285; for l, see p. 227.

NOTE. — Knopp and also Geffcken call attention to the fact that Roth in making his determinations used a rubber tube between the gas burette and the shaking flask, and give this as an explanation of the high results which he obtained.

SOLUBILITY OF NITROUS OXIDE IN AQUEOUS SULPHURIC ACID.

(Lunge — Ber. 14, 2188, '81; see also Geffcken's results.)

Sp. Gr. of H_2SO_4	1.84	1.80	1.705	1.45	1.25
Vols. N_2O dissolved by 100 vols. H_2SO_4	75.7	66.0	39.1	41.6	33.0

100 vols. of KOH solution of 1.12 Sp. Gr. absorb 18.7 vols. N_2O.
100 vols. of NaOH solution of 1.10 Sp. Gr. absorb 23.1 vols. N_2O.

SOLUBILITY OF NITROUS OXIDE IN AQUEOUS SOLUTIONS OF ACIDS.

(Geffcken.)

Results in terms of the Ostwald Solubility Expression (l). See p. 227.

In Hydrochloric Acid. Gms. HCl per Liter.	N_2O Dissolved l_{15}	l_{25}	In Nitric Acid. Gms. HNO_3 per Liter.	N_2O Dissolved l_{15}	l_{25}	In Sulphuric Acid. Gms H_2SO_4 per Liter.	N_2O Dissolved l_{15}	l_{25}
18.22	0.755	0.577	36.52	0.777	0.597	24.52	0.734	0.566
36.45	0.738	0.568	63.05	0.777	0.602	49.04	0.699	0.543
72.90	0.716	0.557	126.10	0.775	0.611	98.08	0.645	0.509
						147.12	0.602	0.482
						196.16	0.562	0.463

SOLUBILITY OF NITROUS OXIDE IN AQUEOUS SOLUTIONS OF:

(Roth.)

t°	Phosphoric Acid. Coefficient of Abs. in H_3PO_4 Solutions of: 3.38%.	4.72%.	8.84%.	9.89%.	13.35%.	Oxalic Acid. Coefficient of Abs. in $(COOH)_2$ Solutions of: 0.812%.	3.70%.
5	1.057	1.0365	0.9883	0.9635	0.9171	1.1450	1.1094
10	0.8827	0.8665	0.8296	0.8101	0.7711	0.9526	0.9264
15	0.7388	0.7258	0.6977	0.6826	0.6505	0.7940	0.7745
20	0.6253	0.6147	0.5926	0.5810	0.5555	0.6694	0.6538
25	0.5427	0.5329	0.5143	0.5054	0.4860	0.5784	0.5643

SOLUBILITY OF NITROUS OXIDE IN AQUEOUS SOLUTIONS OF PROPIONIC ACID AT 20°.

(Knopp)

Gms. C_2H_5COOH per liter	15.15	60.42	158.4	176.6	344.0
Coef. of Absorption of N_2O	0.6323	0.6369	0.6504	0.6534	0.7219

SOLUBILITY OF NITROUS OXIDE IN AQUEOUS SALT SOLUTIONS.

Results by Geffcken in terms of the Ostwald expression (*l*). See page 227.

Salt.	Formula.	Conc. of Salt per Liter.		Solubility of N_2O.	
		Gram Equiv.	Grams.	l_{15}.	l_{25}
Ammonium Chloride	NH_4Cl	0.5	26.76	0.730	0.557
Ammonium Chloride	NH_4Cl	1.0	53.52	0.691	0.529
Caesium Chloride	CsCl	0.5	84.17	0.710	0.544
Lithium Chloride	LiCl	0.5	21.24	0.697	0.535
Lithium Chloride	LiCl	1.0	42.48	0.623	0.483
Potassium Bromide	KBr	0.5	59.55	0.697	0.536
Potassium Bromide	KBr	1.0	119.11	0.627	0.485
Potassium Chloride	KCl	0.5	37.3	0.686	0.527
Potassium Chloride	KCl	1.0	74.6	0.616	0.475
Potassium Iodide	KI	0.5	83.06	0.702	0.541
Potassium Iodide	KI	1.0	166.12	0.633	0.492
Potassium Hydroxide	KOH	0.5	28.08	0.668	0.514
Potassium Hydroxide	KOH	1.0	56.16	0.559	0.436
Rubidium Chloride	RbCl	0.5	60.47	0.695	0.533
Rubidium Chloride	RbCl	1.0	120.95	0.625	0.483

Results by Knopp, in terms of the coefficient of absorption. See page 227.

Salt.	Formula.	Conc. of Salt per Liter.		Coef. of Absorption of N_2O at 20°
		Normality.	Grams.	
Potassium Nitrate	KNO_3	0.1061	10.74	0.6173
"	"	0.2764	27.94	0.6002
"	"	0.5630	56.97	0.5713
"	"	1.1683	118.2	0.5196
Sodium Nitrate	$NaNO_3$	0.1336	11.37	0.6089
"	"	0.3052	25.97	0.5876
"	"	0.6286	53.50	0.5465
"	"	1.1200	95.30	0.4926

Results by Roth, in terms of the coefficient of absorption.

Grams NaCl per 100 Grams Solution.	Coefficient of Absorption of N_2O at:				
	5°.	10°.	15°.	20°.	25°.
0.99	1.0609	0.8812	0.7339	0.0191	0.5363
1.808	1.0032	0.8383	0.7026	0.5962	0.5190
3.886	0.9131	0.7699	0.6495	0.5520	0.4775
5.865	0.8428	0.7090	0.5976	0.5088	0.4424

Solubility of Nitrous Oxide in Aqueous Salt Solutions.

Results by Gordon in terms of coefficient of absorption. See p. 227.

Salt.	Concentration of Salt: Grams per 100 Grams Solution	Gram Mols. per Liter.	Coefficient of Absorption of N_2O at: 5°.	10°.	15°.	20°.
Calcium Chloride	5.79	0.547	0.819	0.697	0.591	0.500
"	9.86	0.964	0.668	0.586	0.509	0.435
"	13.99	1 416	0.510	0.441	0.380	0.328
Lithium Chloride	1.35	0.319	0.985	0.831	0.700	0.594
"	3 85	0 928	0.878	0.743	0.629	0.536
"	11.48	2 883	0.606	0.512	0.437	0.382
Lithium Sulphate	2.37	0.219	0.934	0.792	0 670	0.569
"	5.46	0.521	0.795	0.665	0.557	0.474
"	8 56	0.836	0.646	0.555	0.477	0.415
Magnesium Sulphate	5.90	0 521	0.766	0.664	0.561	0.471
"	7 66	0 687	0.708	0.586	0.488	0.414
"	10 78	0 997	0.569	0.491	0.417	0.346
Potassium Chloride	4.90	0 676	0.879	0.751	0.643	0.555
"	7.64	1.037	0 799	0.693	0 591	0.494
"	14.58	2.147	0 654	0.574	0.500	0.430
"	22.08	3.414	0.544	0.459	0.390	0.339
Potassium Sulphate	2.62	0 154	0 986	0.831	0.701	0.605
"	4 78	0 285	0 918	0.763	0.637	0.542
Sodium Chloride	6.20	1 107	0 800	0 682	0 585	0.509
"	8.88	1 614	0.713	0.603	0.510	0.434
"	12.78	2.391	0.634	0 532	0.449	0.386
Sodium Sulphate	5.76	0.427	0.808	0.677	0.584	0.495
"	8 53	0 646	0.692	0.574	0.482	0.416
"	12.44	0 974	0.559	0.486	0.417	0.354
Strontium Chloride	3.31	0.215	0.928	0.788	0.671	0.578
"	5 73	0.380	0 848	0.709	0 610	0.550
"	13.24	0.939	0.644	0.547	0.463	0.390

Solubility of Nitrous Oxide in Alcohol and in Aqueous Chloral Hydrate Solutions at 20°.

(Bunsen; Knopp — Z. physik. Ch. 48, 106, '04)

In Alcohol (B.): t°.	Vols. N_2O (at 0° and 760 mm) per 1 Vol. Alcohol.	In Aq. Chloral Hydrate (K.): Normality of $C_2HCl_3O.H_2O$.	Gms. $C_2HCl_3O.H_2O$ per Liter.	Coef. of Abs. of N_2O.
0	4.178	0.184	30.43	0.618
5	3.844	0.445	73.60	0.613
10	3.541	0.942	155.8	0.596
15	3.268	1.165	192.7	0.589
20	3.025	1.474	243.8	0.579
24	2.853	1.911	316.4	0.567

Solubility of Nitrous Oxide in Petroleum. Coefficient of Absorption at 10° = 2.49, at 20° = 2.11.

(Gniewasz and Walfisz — Z. physik. Ch. 1, 70, '87.)

SOLUBILITY OF NITROUS OXIDE IN AQUEOUS SOLUTIONS OF GLYCEROL AND OF UREA.
(Roth, 1897.)

t°.	Coefficient of Absorption of N_2O in Glycerol Solutions of:			
	3.46 Per cent	6.73 Per cent	12.12 Per cent	16.24 Per cent
5	1.097	1.055	0.999	0.959
10	0.917	0.887	0.841	0.810
15	0.767	0.745	0.710	0.686
20	0.647	0.630	0.605	0.585
25	0.556	0.542	0.527	0.508

t°.	Coefficient of Absorption of N_2O in Urea Solutions of:				
	3.31 per cent.	4.97 per cent.	6.37 per cent.	7.30 per cent.	9.97 per cent.
5	1.104	1.096	1.088	1.101	1.069
10	0.921	0.920	0.909	0.921	0.901
15	0.771	0.773	0.761	0.772	0.761
20	0.653	0.656	0.644	0.655	0.651
25	0.569	0.567	0.559	0.570	0.569

SOLUBILITY OF NITROUS OXIDE IN AQUEOUS SOLUTIONS OF GLYCEROL.
(Henkel, 1905, 1912.)

Results at 15°.		Results at 20°.	
Per cent Glycerol.	Absorption Coef. α.	Per cent Glycerol.	Absorption Coef. α.
0	0.7327	0	0.6288
2.49	0.7181	2.36	0.6131
3.28	0.7103	4.88	0.5993
7.17	0.6844	6.88	0.5903
10.52	0.6668	9.86	0.5633
14.05	0.6410	15.82	0.5315
17.08	0.6229		

Data for the influence of colloids and fine suspensions on the solubility of nitrous oxide in water at 25° are given by Findlay and Creighton (1910), and Findlay and Howell (1914).

Results for solutions of ferric hydroxide, dextrin, arsenious sulfide, starch, gelatin, glycogen, egg albumen, serum albumen, silicic acid and suspensions of charcoal and of silica are given.

Data for the solubility of nitrous oxide in blood are given by Siebeck (1909) and by Findlay and Creighton (1910–11).

NITROGEN TETROXIDE NO_2.

Data for the solubility of nitrogen tetroxide in ferrous bromide solutions are given by Thomas (1896).

Freezing-point data (solubility, see footnote, p. 1), are given for mixtures of NO_2 + NO by v. Wittorff (1904), and for mixtures of NO_2 + *o* Nitrotoluene by Breithaupt.

NITROCELLULOSE (Soluble Pyroxylin, Tetra and Penta Nitrate).

SOLUBILITY IN ETHER-ALCOHOL MIXTURES.
(Matteoschat, 1914; see also Stepanow, 1907.)

A sample of gun cotton containing 12.95% N was used. The compound was first covered with alcohol and then the amount of ether to yield the desired composition of solvent was added. Lower results were obtained with ready prepared ether-alcohol mixtures.

Ratio of Ether : Alcohol.	Gms. Gun Cotton Dissolved per 100 Gms. Solution in Mixtures Prepared with:			
	99.5 Vol. % Alcohol.	95 Vol. % Alcohol.	90 Vol. % Alcohol.	80 Vol. % Alcohol.
1 : 2	34.4	...	...	...
1 : 1	52.3	42.3	28.7	14.2
2 : 1	40.5	52.4	53.9	45
3 : 1	25	42.4	53	57.5

NOVOCAINE (base) $CH_2(C_6H_4NH_2COO)CH_2[N.(C_2H_5)_2].2H_2O$.

100 cc. H_2O dissolve 0.333 gm. anhydrous novocaine at 20°. (Zalai, 1910.)
100 cc. oil of sesame dissolve 4.29 gms. anhydrous novocaine at 20°. "

NOVOCAINE (Hydrochloride) $CH_2(C_6H_4NH_2COO).CH_2[N(C_2H_5)_2].HCl$.

100 gms. H_2O dissolve about 100 gms. of the salt at room temp.
100 gms. alcohol dissolve about 3 gms. of the salt at room temp.

OCTANE $CH_3(CH_2)_6CH_3$.

RECIPROCAL SOLUBILITY OF OCTANE AND PHENOL.
(Campetti and Del Grosso, 1913.)

t°.	Gms Phenol per 100 Gms Mixture.	t°.	Gms Phenol per 100 Gms. Mixture.
22.55	13.28	49.5 crit. t.	52.2
37.85	22.74	49.35	52.37
38.15	23.53	44.7	71.14
44.70	32.85	30.65	82.01
47.75	41.72	19.65	85.99

OLEIC ACID $C_8H_{17}CH:CH(CH_2)_7COOH$.

SOLUBILITY OF OLEIC ACID IN AQUEOUS ALCOHOL SOLUTIONS AT 25°.
(Seidell, 1910)

Oleic acid of d_{25} = 0.8935 and containing 99.5% acid, determined by titration, was used. It was found that the addition of as little as one drop of this acid to aq. alcohol solutions containing up to 50 wt. % C_2H_5OH caused an opalescence on shaking, therefore, indicating a solubility of less than about 0.05 gm. acid per 100 cc. water or of aq. alcohol. With solutions containing more than 50 wt. % C_2H_5OH the following results were obtained:

Wt. Per cent C_2H_5OH.	cc Oleic Acid per 100 cc Aq Alcohol to produce cloudiness	Remarks.
51	0.08–0.2	Cloudiness gradually increased.
58.2	0.2 –0.4	" " "
65.5	0.3 –0.6	Cloudiness disappeared when about 5.5 cc. acid had been added.
70.2	0.6 –1	" " " " 4.5 cc. " " " "
81.4	∞	No cloudiness appeared at all.

It was found that although the end points obtained by addition of oleic acid to aq. alcohol mixtures are not sharp, they become so when the procedure is changed to addition of H_2O to mixtures of oleic acid and alcohol. By this method perfectly clear liquid may be transformed by one drop of the H_2O to an opalescent mixture which, after standing a few minutes, separates into two liquid layers. Determinations made in this way gave the following observed and calculated quantities.

Gms. of Constituents to Yield Opalescent Mixtures.			Results Calculated from the Plotted Curve.		
Alcohol + Oleic Acid Mixture		H_2O Added to Cause Separation.	Wt Per cent C_2H_5OH in Aq. Alcohol.	cc Oleic Acid per 100 cc. Aq. Alcohol.	Gms Oleic Acid per 100 Gms. Sat. Sol.
C_2H_5OH.	Oleic Acid.				
15.30	1.794	10.4	57	...	0
15.30	3.588	10.2	58.5	0	5
15.30	4.485	9.8	60	11	12.3
15.30	7.175	9.25	62.5	30	20
15.30	11.210	8.05	65	49	30.5
24.42	22.420	10.10	67.5	69	40
15.30	20.810	6.50	70	91	50
1.195	8.969	0.321	75.5	...	68.5
			80	...	88

After standing 24 hours the opalescent mixtures separated into layers which, on analysis, gave the results shown in the following table:

COMPOSITION OF UPPER AND LOWER LAYERS OBTAINED BY THE ADDITION OF WATER TO MIXTURES OF AQUEOUS ALCOHOL AND OLEIC ACID AT 25°. (Con. from p. 466).

Composition of Original Mixture.				After Separation into Two Layers:					
				Lower Layer.			Upper Layer.		
Wt. % C_2H_5OH in Aq. Alc. Used.	cc. Aq. Alcohol Mixture.	cc. Oleic Acid.	cc H_2O to Cause Separation.	cc Total Vol	Sp. Gr.	cc Oleic Acid.	cc. Total Vol.	Sp Gr.	cc Oleic Acid
70.2	25	2	3.90	29	0 893	1.48	1	...	0.35
70.2	25	4	3.70	26	0.890	1 89	6	0.875	1 98
65.5	26 5	5	1.75	22.7	0 891	1.93	9.3	0.875	2.78
70.2	25	8	2.75	16	0 893	0.98	19	0.876	6.59
70.2	25	12.5	1.55	6	0 890	0.37	33 2	0 878	11.87
70.2	35	25	1	4.5	...	0 28	55 5	0 877	24 14

The C_2H_5OH in the two layers could not be determined on account of excessive foaming during distillation of the neutralized solution. Some losses occurred in transferring the original mixtures to the graduated cylinders and differences between final amounts and those originally present are due to these losses.

SOLUBILITY OF OLEIC ACID IN AQUEOUS SOLUTIONS OF BILE SALTS.
(Moore, Wilson and Hutchinson, 1909.)

Solvent.	Gms Oleic Acid per 100 Gms Sat Sol.
Water	less than 0.1
5% Aq. Solution of Bile Salts	about 0.5
5% Aq. Solution of Bile Salts + 1% Lecithin	4

DISTRIBUTION OF OLEIC ACID BETWEEN AQUEOUS ALCOHOL AND BENZINE. (Holde, '10.)

Strength of Aq. Alcohol in Vol. Per cent.	Gm (Approx.) of Oleic Acid in: 50 cc Aq Alcohol Layer	50 cc Benzine Layer. Layer	Dist. Coef.
84 1	0.277	0 723	2 61
76 9	0.112	0 888	7.93
63 7	0.025	0.975	39
50.5	0.006	0 994	166
42.4	0.002	0 998	499

SOLIDIFICATION-POINTS OF MIXTURES OF OLEIC AND STEARIC ACIDS. (Meldrum, '13.)

Solidification Temp.	Per cent Oleic Acid in Mixture.	Solidification Temp.	Per cent Oleic Acid in Mixture
0	54.8	50	44.7
10	53 3	60	41.2
20	51.6	70	36 6
30	49 7	80	30 5
40	47 6		

Additional data for the above system as well as for mixtures of oleic and palmitic acids and for the ternary system oleic, palmitic and stearic acids are given by Carlinfante and Levi-Malvano (1909). Results for Oleic Acid + Stearic acid are also given by Fokin (1912).

TriOLEIN $(C_{18}H_{33}O_2)_3C_3H_5$.

SOLIDIFICATION-POINTS OF MIXTURES OF TRIOLEIN AND OTHER FATS.
(Kremann and Schoulz, 1912.)

Triolein + Tripalmitin. t°.	Wt Per cent Triolein.	Triolein + Tristearin. t°.	Wt Per cent Triolein.	Tripalmitin + Tristearin. t°.	Wt Per cent Tristearin.
−7	100	+28	95.2	60.4	90
+25	93.9	44	85.3	58	75
48.2	78.5	50.7	76 7	57.8	69.4
50	73.9	56	68.8	56	60.2
56.9	53	64.3	47.2	57.2	53
60.9	27.2	64.3	25.4	55.1	43 8
62.6	0	56	0	54.5	31.2
				60.4	8.4

Data for the ternary system, triolein, tripalmitin and tristearin are also given.

OILS. (See also Fats, p. 302.)

SOLUBILITY OF SEVERAL OILS IN ALCOHOL (d_{15} = 0.795) AT 14–15°.

(Davidsohn and Wrage, 1915.)

Oil.	Gms. Oil per 100 Gms. Sat. Sol.
Linseed Oil	3.32
Rape Oil	1.36
Cotton Seed Oil	3.61
Olive Oil	2.25

Results are also given for the solubility of mixtures of oils and fatty acids in alcohol. The following results at 22°, in terms of approx. volume of oil dissolved by 100 volumes of 80% alcohol, are given by Aubert (1902). Nigella oil, 4.3; oil of boldo leaves, more than 100; matico oil, about 20; cascarilla oil, 5; weld-mint oil, 66.

Miscibility curves for various oils with acetone, petroleum and aniline are given by Louise (1911). The use of this data for the identification of oils and the detection of adulterants in them is described.

An extensive series of observations on the solubility of water in oils and on the water content of various oils is given by Umney and Bunker (1912).

Freezing-point data for oil of helianthus annus + stearic acid are given by Fokin (1912).

OSMIC ACID OsO_4, 100 gms. H_2O dissolve 5.88 gms. Osmic Acid at about 15°. (Squire and Caines, 1905.)

OXALIC ACID $H_2C_2O_4.2H_2O$.

SOLUBILITY IN WATER.

(Koppel and Cahn, 1908; for older data see Alluard, Miczynski, 1886; Lamouroux, 1899)

t°	Gms $H_2C_2O_4$ per 100 Gms Sat. Sol.	Solid Phase.	t°.	Gms $H_2C_2O_4$ per 100 Gms Sat. Sol.	Solid Phase.
− 0.064	0.1805	Ice	20	8 69	$H_2C_2O_4.2H_2O$
− 0 152	0 452	"	30	12.46	"
− 0.533	1.820	"	40	17 71	"
− 0.936	3.291	"	50	23 93	"
− 1.50	5.836	"	60	30.71	"
− 0.95	3.302	$H_2C_2O_4.2H_2O$	70	37.92	"
0	3.416	"	80	45 80	"
+10	5.731	"	90.2	54 67	"

$H_2C_2O_4.2H_2O$ melts in its H_2O of crystallization at 98°.

SOLUBILITY OF OXALIC ACID IN AQUEOUS HCl AND IN AQUEOUS HNO_3 AT 30°.

(Masson, 1912)

In Aq. Hydrochloric Acid.				In Aq. Nitric Acid.			
G. Mols. HCl per liter Sat. Sol.	d_{30} Sat. Sol.	G Mols $(COOH)_2$ per liter Sat Sol.	Gms. $(COOH)_2$ per liter Sat Sol.	G Mols HNO_3 per liter Sat. Sol.	d_{30} Sat. Sol.	G Mols $(COOH)_2$ per liter Sat Sol	Gms. $(COOH)_2$ per liter Sat Sol.
0	1.0594	1.479	133.1	0.478	1.0648	1.268	114.1
0.503	1.0561	1.190	107.1	1.606	1.0932	1.039	93.48
0.970	1.0577	1.032	92.85	4.224	1.1666	0.790	71.09
1.939	1 0654	0.821	73.88	9.590	1.3074	0.639	57.50
2.959	1.0757	0 675	60.74	13.62	1.3938	0.847	76.23
4.528	1.0957	0.555	49 95	14.12	1.4060	0 966	86.94
6.026	1.1165	0.525	47.25	15.59	1.4319	1.114	100.2
7.907	1.1494	0.607	54.63	16 92	1.4443	0.840	75.6
9.680	1.1843	0.871	78.38	20.84	1.4819	0.524	47.15
				21.63	1.4917	0.553	49.76

SOLUBILITY OF OXALIC ACID IN AQUEOUS SOLUTIONS OF H_2SO_4 AT 25°. (Wirth, '08.)

Conc. of Aq. H_2SO_4 Normality.	d_{25} of Sat. Sol.	Gms per 100 Gms. Sat Sol. SO_3.	$(COOH)_2$.	Conc of Aq. H_2SO_4 Normality.	d_{25} of Sat. Sol.	Gms per 100 Gms. Sat. Sol. SO_3.	$(COOH)_2$.
0	1.047	0	10.23	4.85	1.157	14	3.92
1	1.064	2.98	8.03	5.67	1.177	16.44	3.51
2.39	1.140	7.30	6.02	6.45	1.220	17.84	3.12
4.36	1.146	12.57	4.26	8.9	1.280	25.92	2.37

SOLUBILITY OF OXALIC ACID IN SEVERAL ALCOHOLS.
(Timofeiew, 1894.)

Alcohol.	t°.	Gms $(COOH)_2$ per 100 Gms. Sat. Sol.	Alcohol.	t°.	Gms. $(COOH)_2$ per 100 Gms. Sat. Sol.
Methyl Alcohol	− 1.5	34.2	Propyl Alcohol	− 1.5	12.2
" "	+20.2	39.8	" "	+18.5	16.7
Ethyl Alcohol	− 1.5	22.4	" "	20.2	17.5
" "	+18.5	26.2	Isobutyl Alcohol	20.2	10.9
" "	20.2	26.9			

SOLUBILITY OF OXALIC ACID IN ABSOLUTE AND IN AQUEOUS ETHER AT 25°.
(Bodtker, 1897; Bourgoin)

100 gms. absolute ether dissolve 1.47 gms. $(COOH)_2.2H_2O$.
100 gms. absolute ether dissolve 23.59 gms. $(COOH)_2$.

In Aqueous Ether Solutions.

Gms. Solid Acid Added per 100 cc. Ether Solution		Gms. per 100 cc. Ether Solution.	
$(COOH)_2.2H_2O$.	$(COOH)_2$.	H_2O	$(COOH)_2$.
(1) 5	0	1.250	0.742
(2) 5	0	0.788	0.720
5	0	0 418	1.044
5	2 44	0 360	3.388
5	4 82	0.484	6.038
5	7 14	0 558	8 538
5	9 42	0 632	10.996
5	11 63	0 676	13 316
5	13 79	0 760	15.684
5	18 18	0 816	17 818
5	22.73	0 816	17 818

(1) Ether saturated with water. (2) Ether containing 0 691 per cent water.

100 gms. glycerol dissolve 15 gms. oxalic acid at 15.5°. (Ossendowski, 1907.)
100 gms. 95% formic acid dissolve 9.74 gms. anhydrous oxalic acid at 16.8°. (Aschan, 1913.)

DISTRIBUTION OF OXALIC ACID BETWEEN WATER AND AMYL ALCOHOL AT 20°.
(Herz and Fischer, 1904)

Millimols ½ $(COOH)_2$ per 10 cc		Gms. $(COOH)_2$ per 100 cc.	
Aq. Layer.	Alcoholic Layer.	Aq. Layer.	Alcoholic Layer.
0.6806	0 1451	0 306	0 0653
2.364	0 7233	1.064	0.326
6.699	2.550	3.015	1.148
10 029	4.300	4 511	1.934

Data for the distribution of oxalic acid between mixtures of amyl alcohol + ether and water at 25° are given by Herz and Kurzer (1910).

DISTRIBUTION OF OXALIC ACID BETWEEN WATER AND ETHER.
(Pinnow, 1915.)

Results at 15°.				Results at 27°.			
Gm. Mols. $(COOH)_2$ per Liter.		Dist Coef of:		Gm. Mols $(COOH)_2$ per Liter.		Dist. Coef. of:	
Water Layer.	Ether Layer.	Total Acid.	Undissoc Acid.	Water Layer.	Ether Layer.	Total Acid.	Undissoc. Acid.
0.3435	0.02945	11.6	8.49	0.760	0.0637	11.9	8.18
0.1885	0.01395	13.5	8.81	0.561	0 0433	13	8.37
0.124	0.00845	14.8	8.69	0.3575	0 0250	14.3	8.26
0.0892	0.00553	16.1	8.72	0.2550	0 0165	15.5	8.12
0.0470	0.00248	19	8.19	0.1754	0.01025	17.1	7.94
0.0435	0.0022	19.8	8.26				

Data for the effect of H_2SO_4 upon the above distribution are also given.
Data similar to the above for a greater range of conc. at 25° are given by Chandler (1908).

OXYGEN O_2.

Solubility in Water. (Winkler, 1891; Bohr and Bock, 1891.)

t°.	Coef. of Absorption β.		q.	cc. O per Liter H_2O.	t°.	Coef. of Absorption β.		q.
0	0.0489*	0.0496†	0.00695	10.187	40	0.0231*	0.0233†	0.00308
5	0.0429	0.0439	0.00607	8.907	50	0.0209	0.0207	0.00266
10	0.0380	0.0390	0.00537	7.873	60	0.0195	0.0189	0.00227
15	0.0342	0.0350	0.00480	7.038	70	0.0183	0.0178	0.00186
20	0.0310	0.0317	0.00434	6.356	80	0.0176	0.0172	0.00138
25	0.0283	0.0290	0.00393	5.776	90	0.0172	0.0169	0.00079
30	0.0261	0.0268	0.00359	5.255	100	0.0170	0.0168	0.00000

* W. † B. and B.

For values of β and q see Ethane, p. 285.

According to determinations by Fox (1909a), which agree satisfactorily with the above, the solubility of oxygen in water is expressed by the formula:

$$1000 \times \text{abs. coef } \beta = 49.239 - 1.3440t + 0.028752t^2 - 0.0003024t^3.$$

References to more recent papers on the solubility of oxygen are given by Coste (1917, 1918).

Solubility of the Oxygen of Air in Water.

t°.	5.2°.	5.65°.	14.78°.	24.8°.
Solubility *	8.856	8.744	7.08	5.762

* cc. Oxygen per 1000 cc. H_2O saturated with air at 760 mm.

Solubility of Oxygen in Water and in Aqueous Solutions of Acids, Bases and Salts. (Geffcken, 1904.)

Aq. Solution of:	Concentration per Liter.		Solubility of Oxygen.*	
	Gram Equiv.	Grams.	$l_{15°}$.	l_{25}.
Water alone	...	...	0.0363	0.0308
Hydrochloric Acid	0.5	18.22	0.0344	0.0296
"	1.0	36.45	0.0327	0.0287
"	2.0	72.90	0.0299	0.0267
Nitric Acid	0.5	36.52	0.0348	0.0302
"	1.0	63.05	0.0336	0.0295
"	2.0	126.10	0.0315	0.0284
Sulphuric Acid	0.5	24.52	0.0338	0.0288
"	1.0	49.04	0.0319	0.0275
"	2.0	98.08	0.0335	0.0251
"	3.0	147.12	0.0256	0.0229
"	4.0	196.16	0.0233	0.0209
"	5.0	245.20	0.0213	0.0194
Potassium Hydroxide	0.5	28.08	0.0291	0.0252
"	1.0	56.16	0.0234	0.0206
Sodium Hydroxide	0.5	20.03	0.0288	0.0250
"	1.0	40.06	0.0231	0.0204
"	2.0	80.12	0.0152	0.0133
Potassium Sulphate	0.5	43.59	0.0294	0.0253
"	1.0	87.18	0.0237	0.0207
Sodium Chloride	0.5	29.25	0.0308	0.0262
"	1.0	58.5	0.0260	0.0223
"	2.0	119.0	0.0182	0.0158

* In terms of the Ostwald Solubility Expression. See page 227.

Solubility of Oxygen in Aqueous Potassium Cyanide Solutions at 20°. (Maclaurin, 1893.)

Gms. KCN per 100 gms. sol.	1	10	20	30	50
Coefficient of absorption β	0.029	0.018	0.013	0.008	0.003

Solubility of Oxygen in Sea Water.

(Fox, 1909a.)

Before using the sample of sea water for the solubility determinations, it was found necessary to add acid, otherwise the CO_2 could not be boiled out or the precipitation of neutral carbonates prevented. The very small amount of acid was titrated back, using phenolphthaleine as indicator.

Results in terms of cc. of oxygen absorbed by 1000 cc. of sea water from a free dry atmosphere at 760 mm. pressure.

The calculated formula expressing the solubility is: $1000\,a = 10.291 - 0.2809\,t + 0.006009\,t^2 + 0.0000632\,t^3 - \mathrm{Cl}\,(0.1161 - 0.003922\,t + 0.0000631\,t^2)$.

Parts Chlorine per 1000.	$t°=0°$.	4°.	8°.	12°.	16°.	20°.	24°.	28°.
0	10.29	9.26	8.40	7.68	7.08	6.57	6.14	5.75
4	9.83	8.85	8.04	7.36	6.80	6.33	5.91	5.53
8	9.36	8.45	7.68	7.04	6.52	6.07	5.67	5.31
12	8.90	8.04	7.33	6.74	6.24	5.82	5.44	5.08
16	8.43	7.64	6.97	6.43	5.96	5.56	5.20	4.86
20	7.97	7.23	6.62	6.11	5.69	5.31	4.95	4.62

A recalculation of Fox's determinations to parts per million, with correction for vapor pressure, is published by Whipple and Whipple (1911).

Additional data on the solubility of atmospheric oxygen in sea water are given by Clowes and Biggs (1904).

Data for the solubility of oxygen in water under pressures up to 10 atmospheres are given by Cassuto (1913). The solubility increases at a somewhat slower rate than proportional to the pressure.

Solubility of Oxygen in Aqueous Salt Solutions at 25°.

(MacArthur, 1916)

Aq Salt Solution.	d_{25} Aq Solution.	cc Oxygen per Liter.	Aq Salt Solution.	d_{25} Aq. Solution.	cc Oxygen per Liter.	Aq Salt Solution.	d_{25} of Solution.	cc Oxygen per Liter.
Dist. H_2O	1	5.78	0.25 *n* KBr	1.019	5.29	0.125*n* NaBr	1.007	5.65
0.125*n* NH_4Cl	1.0015	2.31	2 *n* "	1.079	3.27	0.25 *n* "	1.017	5.52
0.25 *n* "	1.0025	1.16	4 *n* "	1.162	1.84	0.50 *n* "	1.036	5.15
1 *n* "	1.014	0.07	0.125*n* KCl	1.003	5.52	1 *n* "	1.075	4.47
0.125*n* $BaCl_2$	1.019	5.40	0.25 *n* "	1.0086	5.30	2 *n* "	1.150	3.37
0.25 *n* "	1.042	5.04	0.50 *n* "	1.020	4.98	3 *n* "	1.219	2.57
0.50 *n* "	1.082	4.27	1 *n* "	1.042	4.26	4 *n* "	1.305	2.02
1 *n* "	1.177	3.10	2 *n* "	1.086	3.21	6 *n* "	1.455	1.28
0.25 *n* $CaCl_2$	1.022	5.08	3 *n* "	1.134	2.36	0.125*n* NaCl	1.0022	5.52
1 *n* "	1.084	3.71	4 *n* "	1.170	1.86	0.25 *n* "	1.0067	5.30
5 *n* "	1.34	2.14	0.125*n* KI	1.013	5.65	0.50 *n* "	1.017	4.92
0.125*n* CsCl	1.014	5.67	0.25 *n* "	1.027	5.49	1 *n* "	1.038	4.20
0.125*n* LiCl	1.0004	5.63	0.50 *n* "	1.056	5.20	2 *n* "	1.075	3.05
0.50 *n* "	1.0091	5.17	1 *n* "	1.116	4.75	3 *n* "	1.112	2.24
1 *n* "	1.021	4.59	2 *n* "	1.23	3.77	4 *n* "	1.149	1.62
2 *n* "	1.044	3.63	5 *n* "	1.46	1.81	0.125*n* Na_2SO_4	1.014	5.04
3 *n* "	1.113	1.97	0.25 *n* KNO_3	1.015	5.49	0.25 *n* "	1.032	4.60
4 *n* "	1.220	1.12	0.50 *n* "	1.029	5.11	0.50 *n* "	1.063	3.97
0.125*n* $MgCl_2$	1.011	5.35	1 *n* "	1.059	4.61	1 *n* "	1.130	3
0.50 *n* "	1.044	4.37	2 *n* "	1.110	3.65	0.125*n* Sucrose	1.015	5.40
1 *n* "	1.085	3.18	0.125*n* K_2SO_4	1.016	5.11	0.25 *n* "	1.033	4.82
2 *n* "	1.160	2.22	0.25 *n* "	1.032	4.66	0.50 *n* "	1.063	4.39
4 *n* "	1.284	0.78	0.5 *n* "	1.060	3.89	1 *n* "	1.147	3.20
5 *n* "	1.343	0.54	0.125*n* RbCl	1.0094	5.65	2 *n* "	1.336	1.84

SOLUBILITY OF OXYGEN IN AQUEOUS SULFURIC ACID SOLUTIONS.

Results at 21°. (Bohr, 1910.) Results at 20°. (Christoff, 1906).

Normality of H_2SO_4.	Absorp. Coef. β.	Normality of H_2SO_4.	Absorp. Coef. β.	Wt. % H_2SO_4.	Ostwald Solubility Expression l_{20}.
0	0.0310	24.8	0.0103	0	0.03756
4.9	0.0195	29.6	0.0117	35.82	0.01815
8.9	0.0155	34.3	0.0201	61.62	0.01407
10.7	0.0143	35.8 (=96%)	0.0275	95.60	0.03303
20.3	0.0119				

SOLUBILITY OF OXYGEN IN ETHYL ALCOHOL, METHYL ALCOHOL AND IN ACETONE.

(Timofejew — Z. physik. Ch. 6, 151, '90; Levi — Gazz. chim. ital. 31, II, 513, '01.)

t°.	In Ethyl Alcohol of 99.7% (T.). β.	β'.	In Methyl Alcohol (L.) l =	In Acetone (L.) l =
0	0.2337	0 2297	0.31864	0.2997
5	0.2301	0.2247	0.30506	0.2835
10	0.2266	0.2194	0.29005	0.2667
15	0.2232	0.2137	0.27361	0.2493
20	0.2201	0.2073	0.25574	0.2313
25	0.2177 (24°)	0.2017 (24°)	0.23642	0.2127
30	...	...	0 21569	0.1935
40	...	...	0.16990	0.1533
50	...	...	0.11840	0.1057

For values of β and β', see Ethane, p. 285. l = Ostwald Solubility Expression. See p. 227.

The formulæ expressing the solubility of oxygen in methyl alcohol and in acetone as shown in the above table are as follows:

In Methyl Alcohol $l = 0.31864 - 0.002572\,t - 0.00002866\,t^2$.

In Acetone $l = 0.2997 - 0.00318\,t - 0.000012\,t^2$.

The formula expressing the absorption coefficient of oxygen in ethyl alcohol is $\beta = 0.23370 - 0.00074688\,t + 0.000003288\,t^2$.

SOLUBILITY OF OXYGEN IN AQUEOUS ALCOHOL AT 20° AND 760 MM.

(Lubarsch, 1889.)

Wt. Per cent Alcohol.	Vol. Per cent Absorbed O.	Wt. Per cent Alcohol	Vol. Per cent Absorbed O.	Wt Per cent Alcohol.	Vol. Per cent Absorbed O.
0	2.98	23.08	2.52	50	3.50
9.09	2.78	28.57	2.49	66.67	4.95
16.67	2.63	33.33	2.67	80	5.66

SOLUBILITY OF OXYGEN IN PETROLEUM. COEFFICIENT OF ABSORPTION AT 10° = 0.229, AT 20° = 0.202.

(Gniewasz and Walfisz, 1887.)

SOLUBILITY OF OXYGEN ETHYL ETHER.

(Christoff, 1912)

Results in terms of the Ostwald Solubility Expression, $l_0 = 0.4235$, $l_{10} = 0.4215$.

SOLUBILITY OF OXYGEN IN AQUEOUS SOLUTIONS OF:

Chloral Hydrate at 20°. (Müller, 1912-13.) Glycerol at 15°. (Müller, 1912-13.)

Gms. $CCl_3.CH(OH)_2$ per 100 Gms. Aq. Sol.	d_{20} of Aq. Sol.	Abs Coef. β (Bunsen) at 20°.	Gms. $(CH_2OH)_2CHOH$ per 100 Gms. Aq Sol.	d of Aq. Sol.	Abs. Coef. β (Bunsen) at 15°.
16.0	1.0798	0.02795	20.5	$d_{12.5}$ = 1.0509	0.02742
32	1.1630	0.02495	25	d_{13} = 1.0621	0.02521
52.9	1.2935	0.02325	37.3	$d_{14.5}$ = 1.0957	0.02022
61.08	1.354	0.02410	45	$d_{12.5}$ = 1.1161	0.01744
65.5	1.382	0.02580	52	$d_{12.5}$ = 1.1351	0.01570
71.4	1.4404	0.02730	71.5	$d_{12.5}$ = 1.1908	0.00950
78	1.46	0.03280	88.5	$d_{13.5}$ = 1.236	0.00886

SOLUBILITY OF OXYGEN IN AQUEOUS SOLUTIONS OF:

Glucose at 20°. (Müller, 1912-13.) Cane Sugar at 15°. (Müller, 1912-13.)

Gms. $C_6H_{12}O_6$ per 100 Gms. Aq Sol.	d_{20} of Aq Sol	Abs Coef β (Bunsen) at 20°	Gms $C_{12}H_{22}O_{11}$ per 100 Gms. Aq Sol.	d_{15} of Aq Sol.	Abs Coef β (Bunsen) at 15°.
10.84	1.0413	0.02690	12.1	1.0482	0.02969
20.7	1.0835	0.02250	24.38	1.1022	0.02396
33.8	1.1370	0.01815	28.44	1.1205	0.02181
51.9	1.2295	0.01390	42.96	1.1938	0.01600
58.84	1.2649	0.01250	50	1.2318	0.01359

INFLUENCE OF ANESTHETICS UPON THE SOLUBILITY OF OXYGEN IN OLIVE OIL.
(Hamberger, 1911.)

Name and Conc of Narcotic Added to the Oil.		Solubility of Oxygen in: Pure Solvent	Narcotic Solution	Name and Conc of Narcotic Added to the Oil.		Solubility of Oxygen in: Pure Solvent	Narcotic Solution.
Sulfonal	(0 8 per 100)	9 69	4 55	Monochlorhydrine	(5 per 100)	9 10	7 50
"		9.69	5 68	"	(2 5 ")	9 10	7 50
"		9 69	6 25	"	(1 25 ")	9 10	7 90
Trional	(saturated)	9 10	4 55	Dichlorhydrine	(10 ")	9 10	7 96
"		9 10	5 68	"	(5 ")	9 10	8
Tetronal	(2 per 100)	9 67	9 10	Phenylurethan	(5 ")	8 53	6 25
"		9 67	9 20	"	(2.5 ")	8 53	7 50
Camphor	(10 per 100)	8 53	7.96				

Data for the solubility of oxygen in liquid air are given by Baly (1900).

Data for the solubility of oxygen in hemoglobin are given by Jolin (1889).

Data for the solubility of oxygen in defibrinated ox-blood and ox-serum, at pressures varying from 760 to about 1400 mm. Hg, are given by Findlay and Creighton (1911).

OZONE O_3.

SOLUBILITY IN WATER.
(von Mailfert, 1894; Carius; Schone, 1873.)

t°.	*W.*	*G.*	*R*	t°.	*W.*	*G.*	*R.*
0	39.4	61.5	0.641	27	13.9	51.4	0.270
6	34.3	61	0.562	33	7.7	39.5	0.195
11.8	29.9	59.6	0.500	40	4.2	37.6	0.112
13	28	58.1	0.482	47	2.4	31.2	0.077
15	25.9	56.8	0.456	55	0.6	19.3	0.031
19	21	55.2	0.381	60	0	12.3	0

W = milligrams ozone dissolved per liter water. *G* = milligrams ozone in one liter of the gas phase above the solutions. *R* = ratio of the dissolved to undissolved ozone ($W \div G$).

The experiments of Schöne (see preceding page) were repeated by Inglis (1903). "The results confirm Schöne's experiments and indicate that ozone, when passed through water, is partly decomposed."

According to Moufang (1911) the solubility of ozone in distilled water ranges from about 10 milligrams per liter at 2° to about 1.5 milligrams per liter at 28°. The solubility is greatly affected by other substances in solution. Small amounts of acids increase the solubility and render the aqueous solution of the ozone more permanent. Alkalis decrease the solubility. Neutral salts (*i.e.*, calcium sulfate) increase the solubility.

SOLUBILITY OF OZONE IN DILUTE SULFURIC ACID.
(Rothmund, 1912)

The explanation of the discrepancies concerning the solubility of ozone in water is that the ozone quickly decomposes as the saturation point is reached. Rothmund, therefore, determined the solubility in dilute H_2SO_4 in which decomposition takes place much more slowly than in pure water. At 0° the absorption coef. β (Bunsen, see p. 227) in 0.1 *n* H_2SO_4, is 0.487. The coef. remains practically the same when the concentration of the ozone is changed over a wide range, hence Henry's Law holds for ozone. The dissolved ozone has the same molecular weight as the gaseous. The solubility depression which ozone experiences through 0.1 *n* H_2SO_4 is calculated as 1.5%. Therefore, by extrapolation, it is calculated that the abs. coef. β of ozone in H_2O at 0°, is 0.494.

PALLADIUM CHLORIDE $PdCl_2$.

When 1 gm. of palladium, as chloride, is dissolved in 100 cc. of H_2O and shaken with 100 cc. of ether, 0.02 per cent of the metal enters the ethereal layer at ord. temp. When aq. 10% HCl is used, 0.01 per cent of the metal enters the ethereal layer. (Mylius, 1911.)

100 cc. anhydrous hydrazine dissolve 1 gm. $PdCl_2$, with evolution of gas and formation of a black precipitate, at room temperature. (Welsh and Broderson, 1915.)

PALMITIC ACID $CH_3(CH_2)_{14}COOH$.

SOLUBILITY IN AQ. AND ABSOLUTE ETHYL ALCOHOL.
(Falciola, 1910.)

t°.	Gms $CH_3(CH_2)_{14}COOH$ per 100 cc: Absolute Alcohol.	Aq 75% Alcohol.	Aq 50% Alcohol.
10	2.8	0.24	0.05
20	9.2	0.43	0.08
30	...	1.19	0.12
40	31.9	3.59	0.31

100 cc. sat. solution of palmitic acid in methyl alcohol of 94.4 vol. % (d = 0.8183) contain 1.03 to 1.17 gms. at 0.2°, equilibrium being approached from above. The mixtures were simply allowed to stand in an ice chest for from 12 to 156 hours. (Hehner and Mitchell, 1897.)

SOLUBILITY OF PALMITIC ACID IN SEVERAL ALCOHOLS.
(Timofeiew, 1894.)

Alcohol.	t°.	Gms $CH_3(CH_2)_{14}COOH$ per 100 Gms. Sat. Sol.	Alcohol.	t°.	Gms. $CH_3(CH_2)_{14}COOH$ per 100 Gms. Sat. Sol.
Methyl Alcohol	0	0.72	Propyl Alcohol	0	2.92
"	21	5.1	"	21	13.8
"	36	29.5	Isobutyl Alcohol	0	2.2
Ethyl Alcohol	0	2	"	21	12.8
"	21	10.1			

One hundred gms. of aq. 5% solution of bile salts dissolve about 0.1 gm. palmitic acid. 100 gms. aq. 5% solution of bile salts containing 1% of lecithin dissolve 0.6 gms. palmitic acid. (Moore, Wilson and Hutchinson, 1909.)

SOLIDIFICATION POINTS OF MIXTURES OF PALMITIC AND STEARIC ACIDS.
(De Visser, 1898)

Fifty gram samples of each mixture were used and great care taken to insure accuracy of the determinations.

t° of Solidification.	Gms Stearic Acid per 100 Gms. Mixture.	t° of Solidification.	Gms. Stearic Acid per 100 Gms. Mixture.	t° of Solidification.	Gms. Stearic Acid per 100 Gms. Mixture.
69.32	100	57.2	55	54.85 Eutec.	30
67.02	90	56.42	50	55.46	25
64.51	80	56.38	45	56 53	20
61.73	70	56.11	40	59 31	10
58.76	60	55.62	36	62.62	0

Additional determinations on this system by Dubowitz (1911) are, for the most part, in good agreement with the above. According to Carlinfanti and Levi Malvano (1909), however, the eutectic could not be located and there were indications of the existence of solid solutions.

DATA ARE GIVEN FOR THE SOLIDIFICATION POINTS OF THE FOLLOWING MIXTURES:

Palmitic Acid + Tripalmitin	(Kremann and Klein, 1913)
" + " + Stearic Acid.	" "
" + " + Tristearin.	(Kremann and Kropsch, 1914.)
" + Tristearin + Stearic Acid.	" "
" + Tristearin.	" "
Tripalmitin + Tristearin + Stearic Acid.	" "
" + Stearic Acid.	(Kremann and Klein, 1913.)
Palmitic Acid Cetyl Ester + Paraffin.	(Palazzo and Battelli, 1883.)

PAPAVERINE $C_{20}H_{21}NO_4$.

100 gms. carbon tetrachloride dissolve 0.203 gm. at 17°. (Schindelmeiser, 1901.)

100 gms. carbon tetrachloride dissolve 0.518 gm. at 20°. (Gori, 1913.)

100 gms. ethyl ether dissolve 0.38 gm. at 10°.

100 gms. of each of the following solvents dissolve the stated amount of papaverine at 20°. Aniline, 29 gms.; pyridine, 8 gms.; piperidine, 1 gm.; diethylamine, 0.4 gm. (Scholtz, 1912.)

PARAFFIN.

SOLUBILITY OF OZOKERITE PARAFFIN OF MELTING POINT 64°–65° AND SP. GR. AT 20° = 0.917 IN SEVERAL SOLVENTS AT 20°.
(Pawlewski and Filemonowicz, 1888)

Solvent.	Gms Paraffin per 100 Gms Solvent.	Gms Paraffin per 100 cc Solvent	Solvent.	Gms. Paraffin per 100 Gms Solvent	Gms. Paraffin per 100 cc. Solvent.
Carbon Disulfide	12 99		Acetone	0 262	0.209
Benzine, boiling below 75°	11 73	8 48	Ethyl Acetate	0 238	...
Turpentine, b. pt. 158°–166°	6 06	5 21	" Alcohol	0 219	...
Cumol, com. b. pt. 160°	4 26	3 72	Amyl Alcohol	0.202	0.164
" frac. 150°–160°	3 99	3 39	Propionic Acid	0 165	...
Xylene, com. b. pt. 135°–143°	3 95	3 43	Propyl Alcohol	0 141	...
" frac. 135°–138°	4.39	3.77	Methyl Alcohol	0 071	0.056
Toluene, com. b. pt. 108°–110°	3 88	3 34	Methyl Formate	0 060	...
" frac. 108°–109°	3 92	3 41	Acetic Acid	0 060	0.063
Chloroform	2.42	3.61	" Anhydride	0.025	...
Benzene	1.99	1 75	Formic Acid	0.013	0 015
Ethyl Ether	1.95	...	Ethyl Alcohol 75%	0.0003	...
Isobutyl Alcohol, com.	0.285	0.228			

F.-pt. data for paraffin + stearin are given by Palazzo and Battelli (1883).

PENTANE $CH_3(CH_2)_3CH_3$.

Data for the solubility of pentane in liquid carbon dioxide, determined by the synthetic method, are given by Büchner (1906).

Iso**PENTANE** $(CH_3)_2CH.CH_2CH_3$.

RECIPROCAL SOLUBILITY OF ISOPENTANE AND PHENOL. (Campetti and Del Grosso, 1913.)

t°.	Gms. Phenol per 100 Gms. Isopentane Rich Layer.	Gms. Phenol per 100 Gms. Phenol Rich Layer.
20	4.5	87
30	7	83.5
40	11.5	80
50	18	75.5
60	29.5	68
65	40	58
66 crit. temp.	50	

F.-pt. data for mixtures of hexachloro-α-keto γ-R-pentene, C_5Cl_6O, + penta chloromonobromo α-keto γ-R pentene, C_5Cl_5BrO, are given by Küster (1890, 1891).

PEPTONE.

100 gms. H_2O dissolve 42.2 gms. peptone at 20–25°. (Dehn, 1917.)
" pyridine " 0.22 " " " "
" aq. 50% pyridine " 12.6 " " " "

PERCHLORIC ACID $HClO_4$.

SOLUBILITY IN WATER. (van Wyk, 1902, 1905.)

Mixtures of $HClO_4$ and water were cooled until crystals appeared and then very gradually warmed and constantly stirred while an observation was made of the exact temperature at which the last crystal disappeared. At certain concentrations and temperatures unstable solid phases were obtained, also, curves for two series of mix crystals were encountered. The methods for detecting these phases consisted in seeding the saturated solutions with the several different crystalline forms, and observing the change in rate of cooling during the solidification of the mixture. The data for the mix-crystal curves I and II are not given in the following table:

t°.	Mols $HClO_4$ per 100 Mols. $HClO_4+H_2O$.	Solid Phase.	t°.	Mols $HClO_4$ per 100 Mols. $HClO_4+H_2O$.	Solid Phase.
0	0	Ice	−32	26	$HClO_4.2\frac{1}{2}H_2O$
−10	5	"	−29.8	28.57	"
−21	7	"	−44	27	$HClO_4.2H_2O$
−34.5	9	"	−41	27.25	"
−54	11	"	−34	28	"
−50.5	19	$HClO_4.3\frac{1}{2}H_2O$	−24	29.9	"
−45	20	"	−17.8 m pt	33.3	"
−42.3	21	"	−21.5	36	"
−41.4	22.22	"	−23.6	36.5	" $+HClO_4.H_2O$
−43	23.5	"	−12.5	37	$HClO_4.H_2O$
−40.5	22.5	$HClO_4.3H_2O\ \alpha$	+3	38	"
−39.5	22.75	"	28	40.8	"
−37.6	24	"	40	43.7	"
−37.5	26	"	50 m. pt.	50	"
−38.8	27	"	45	59.9	"
−47.8	22.5	$HClO_4.3H_2O\ \beta$	27.5	71.5	"
−44	24	"	17	77.2	"
−43.5	24.5	"	+2.2	83.3	"
−43.2	25	"	−21.5	90.7	"
−44.5	26	"	−40	94	"
−37.2	25	$HClO_4.3H_2O\alpha+HClO_4.2\frac{1}{2}H_2O$	−102	100	"

PETROLEUM ETHER.

100 cc. H_2O dissolve 0.005 cc. petroleum ether at 15°. (Groschuff, 1910.)

PHENACETIN (*p* Acetphenetidin) $C_6H_4(OC_2H_5)NHCH_3CO$ *p*.

SOLUBILITY IN AQUEOUS ALCOHOL AT 25°.
(Seidell, unpublished.)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_6H_4(OC_2H_5)NHCH_3CO$ per 100 Gms. Sat. Solution	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_6H_4(OC_2H_5)NHCH_3CO$ per 100 Gms. Sat. Solution.
0 (water)	1	0.0766	70	0.879	6.25
10	0.984	0.14	80	0.858	7.63
20	0.968	0.28	85	0.847	7.88
30	0.952	0.65	90	0.834	7.82
40	0.935	1.50	92.3	0.827	7.70
50	0.917	2.85	95	0.821	7.45
60	0.898	4.55	100	0.806	6.64

100 gms. H_2O dissolve 1.43 gms. phenacetin at the b. pt. (U. S. P., VIII.)
100 gms. 92.3 wt. % alcohol dissolve about 50 gms. phenacetin at the b. pt. "

SOLUBILITY OF PHENACETIN IN SEVERAL SOLVENTS.
(Seidell, 1907.)

Solvent.	t°.	Gms. Phenacetin per 100 Gms. Sat. Solution.	Solvent.	t°.	Gms. Phenacetin per 100 Gms. Sat. Solution.
Acetone	30–31	10.68	Benzene	30–31	0.65 (0.873)
Amyl Acetate	30–31	2.42 (0.865)	Chloroform	25	4.76
Amyl Alcohol	25	3.51 (0.819)	Ether	25	1.56
Acetic Acid (99.5%)	21.5	13.65 (1.064)	Toluene	25	0.30 (0.863)
Aniline	30–31	9.46 (1.025)	Xylene	32.5	1.25 (0.847)
Benzaldehyde	30–31	8.44 (1.063)			

(Figures in parentheses are Sp. Gr. of Sat. Solutions.)

100 cc. petroleum ether dissolve 0.015 gm. phenacetin at room temp. (Salkower, 1916.)
100 gms. pyridine dissolve 17.39 gms. phenacetin at 20–25°. (Dehn, 1917.)
100 gms. aq. 50% pyridine dissolve 28.94 gms. phenacetin at 20–25°. "

PHENANTHRAQUINONE $C_6H_4CO_2CO_2C_6H_4$.

SOLUBILITY IN BENZENE AND IN ETHYL ACETATE.
(Tyrer, 1910.)

Solubility in Benzene.			Solubility in Ethyl Acetate.		
t°.	Sp. Gr. of Sat. Solution.	Gms. $(C_6H_4)_2(CO_2)_2$ per 100 Gms. Benzene.	t°.	Sp. Gr. of Sat. Solution.	Gms. $(C_6H_4)_2(CO_2)_2$ per 100 Gms. Ethyl Acetate.
10	0.8902	0.412	10	0.9102	0.518
15	0.8850	0.471	20	0.9025	0.626
20	0.8800	0.538	30	0.8906	0.770
30	0.8698	0.738	40	0.8789	0.995
40	0.8601	1.032	50	0.8674	1.292
50	0.8506	1.354	60	0.8561	1.640
60	0.8415	1.760	65	0.8508	1.902
70	0.8327	2.687	70	0.8454	2.215
80	0.8241	3.770	75	0.8401	2.515

NOTE. — The Sp. Gr. determinations given in the above table and in the tables for anthracene and anthraquinone, pp. 81 and 82, are not included in the original paper of Tyrer (1910) but, in response to my request, have been kindly supplied for the present volume. I am also indebted to Dr. Tyrer for the modified form of his original tables showing the solubilities of anthraquinone and phenanthraquinone in mixed solvents. (A. S.)

SOLUBILITY OF PHENANTHRAQUINONE IN MIXTURES OF ORGANIC SOLVENTS.

(Tyrer, 1910.)

In C_6H_6 + Hydrocarbons (1) at 48°.		In $CHCl_3$ + Pentane at 14.5°.		In $CH_3COOC_2H_5$ + Hydrocarbons(1) at 48°.	
Per cent C_6H_6 in Mixed Solvent	Gms. Phenanthraquinone per 100 Gms. Solvent.	Per cent $CHCl_3$ in Mixed Solvent.	Gms. Phenanthraquinone per 100 Gms. Solvent.	Per cent $CH_3COOC_2H_5$ in Mixed Solvent.	Gms. Phenanthraquinone per 100 Gms. Solvent.
0	0.0708	0	0.025	0	0.073
10	0.088	10	0.045	14.19	0.126
20	0.118	20	0.080	27.37	0.207
30	0.160	30	0.115	39.94	0.335
40	0.228	40	0.165	52.12	0.494
50	0.318	50	0.220	63.56	0.656
60	0.440	60	0.330	74.19	0.817
70	0.588	70	0.525	84.62	0.993
80	0.772	80	0.805	90	1.073
90	1.004	90	1.415	100	1.230
100	1.288	100	2.402		

(1) Distilled from petroleum, b. pt. = 82°–92°. (See note, preceding page.)

PHENANTHRENE $C_{14}H_{10}$.

SOLUBILITY IN ALCOHOL AND IN TOLUENE.*

(Speyers — Am. J. Sci. [4] 14, 295, '02.)

	In Alcohol.		In Toluene.	
t°.	Gms. $C_{14}H_{10}$ per 100 Grams C_2H_5OH.	Sp. Gr. of Solutions (H_2O at 4°.)	Gms. $C_{14}H_{10}$ per 100 Grams $C_6H_5.CH_3$	Sp. Gr. of Solutions (H_2O at 4°.)
0	3.65	0.814	23.0	0.925
10	3.80	0.807	30.0	0.929
20	4.6	0.801	42.0	0.934
25	5.5	0.799	50.0	0.939
30	6.4	0.797	58.0	0.943
40	8.2	0.795	76.0	0.955
50	10.6	0.794	95.0	0.971
60	15.6	0.797	115.0	0.989
70	33.0	0.815	135.0	1.007
80	...	0.865 (76.4°)	155.0	1.027

* Calculated from the original results which are given in terms of gram molecules of Phenanthrene per 100 gram molecules of solvent, and for irregular intervals of temperature.

Behrend, 1892, reports 2.77 gms. phenanthrene per 100 gms. alcohol at 12.3°, and 3.09 gms. at 14.8°.

SOLUBILITY OF PHENANTHRENE IN ORGANIC ACIDS. (Timofeiew, 1894.)

Acid.	t°.	Gms. $C_{14}H_{10}$ per 100 Gms. Sat. Sol.	Acid.	t°.	Gms. $C_{14}H_{10}$ per 100 Gms. Sat. Sol.
Acetic Acid	23	8.31	Propionic Acid	23	17
" "	39	9.8	" "	39	21.4
" "	70.5	34.6	" "	62.4	40.3
Butyric Acid	23	15.6	Isobutyric Acid	23	12.3
" "	39	21	Valeric Acid	39	16.6

100 gms. 95% formic acid dissolve 0.46 gms. $C_{14}H_{10}$ at 20.8°. (Aschan, 1913.)

F.-pt. data for mixtures of phenanthrene and each of the following compounds are given by Kremann *et. al.*, (1908); 1.2.6 dinitrotoluene, 1.2.4. dinitrotoluene, 1.3.4 dinitrotoluene, trinitrotoluene and trinitrobenzene. Results for mixtures of phenanthrene and 2.4 dinitrotoluene are given by Kremann and Hofmeier (1910).

SOLUBILITY OF PHENANTHRENE IN SEVERAL SOLVENTS AT 25°.

(Hildebrand, Ellefson and Beebe, 1917.)

Solvent.	Gms. $C_{14}H_{10}$ per 100 Gms. Solvent.	Solvent.	Gms. $C_{14}H_{10}$ per 100 Gms. Solvent.
Alcohol	4.91	Carbon Tetrachloride	26.3
Benzene	59.5	Ether	42.9
Carbon Disulfide	80.3	Hexane	9.15

SOLUBILITY OF PHENANTHRENE PICRATE IN ABSOLUTE ALCOHOL.

(Behrend, 1892)

t°.	Grams per 100 Grams Saturated Solution.		
	Picric Acid +	Phenanthrene =	Phenanthrene Picrate.
12.3	0.91	0.71	1.62
14.3	1.00	0.78	1.78
17.5	1.05	0.82	1.87

SOLUBILITY OF PHENANTHRENE PICRATE IN ALCOHOLIC SOLUTIONS CONTAINING PICRIC ACID AND ALSO PHENANTHRENE.

(Behrend.)

t°.	Grams Added to 62 cc. Abs. Alcohol.			Gms. per 100 Gms. Sat. Solution.		
	P. Picrate +	Picric Ac. +	Phenanthrene.	Picric Ac. +	Phenanthrene =	P. Picrate.
12.3	1.4	0	0.5	0.534	1.413	1.947
12.3	1.4	0	0.9	0.409	2.141	2.550
12.3	0.8	0	2.1	0.354	2.77	3.124
12.3	0.8	0	4.0	0.139	5.626	5.765
17.5	1.4	0.1	0	1.159	0.75	1.91
17.5	1.4	0.2	0	1.285	0.68	1.97
17.5	1.4	1.0	0	2.45	0.37	2.82
17.5	1.4	4.0	0	6.15	0.195	6.345
17.5	1.4	0.0	2.2	0.423	3.276	3.699

PHENOL C_6H_5OH.

SOLUBILITY IN WATER.

(Alexejew, 1886; Schreinemaker, 1900; Rothmund, 1898)

The determinations were made by the "Synthetic Method," for which, see Note, p. 16.

t°.	Gms Phenol per 100 Gms	
	Aqueous Layer.	Phenol Layer.
10	7.5	75
20	8.3	72.1
30	8.8	69.8
40	9.6	66.9
50	12	62.7
55	14.1	59.5
60	16.7	55.4
65	21.9	49.2
68.3 (crit. temp.)	33.4	

Results confirming the above, and also viscosity measurements, are given by Scarpa (1904).

The complete $T - x$ data for the system are given by Smits and Maarse (1911).

F.-pt. data for the system are given by Rózsa (1911) and Paterno and Ampola (1897).

Vaubel (1895) states that 100 gms. sat. aqueous solution contain 6.1 gms. phenol at 20°. Sp. Gr. of solution = 1.0057.

PHENOL.

SOLUBILITY OF PHENOL IN AQUEOUS ACETONE SOLUTIONS.
(Schreinemakers, 1900.)

t°.	In 4.24% Acetone. Grams Phenol per 100 Gms. Aq. Acetone Layer.	Phenol Layer.	In 12.2% Acetone. Gms. Phenol per 100 Gms. Aq. Acetone Layer.	Phenol Layer.	In 24.6% Acetone. Gms. Phenol per 100 Gms. Aq. Acetone Layer.	Phenol Layer.	In 59.9% Acetone. Gms. Phenol per 100 Gms. Aq. Acetone Layer.	Phenol Layer
20	...	...	...	...	...	...	26.0	60.5
30	5.0	74.0	4.0	71.0	6.0	69.5	28.5	57.0
40	5.5	70.0	...	...	...	...	32.0	52.0
50	5.7	67.0	5.0	67.0	8.0	64.0	34.5§	49.0§
60	6.5	61.0	...	...	...	...	36.5‖	46.5‖
70	9.0	51.0	7.5	57.5	19.0	57.0	(49.5°) 41.5	
80	14.0	34.0	10.5	49.5	14.0	52.5		
	(84°) 22.5		20.4*	30.5*	23.0†	47.0†		
			(90.3°) 25.0		26.5‡	44.0‡		
					(90.5°) 35.0			

*90° †85° ‡87°.5 §45° ‖47°.5

The figures in the above table were read from curves plotted from the original results. Similar data are also given for acetone solutions of seven other concentrations.

The determinations were made by adding various quantities of phenol to the mixtures of water and acetone and observing the temperature at which the two layers became homogeneous. The isothermal lines for 30°, 50°, 68°, 80°, 85° and 87° were located. The results for 30° and 80° are as follows: (Schreinemakers, 1900.)

Results at 30°.

Gms. per 100 Gms. Mixture. H_2O.	$(CH_3)_2CO$.	C_6H_5OH.	Gms per 100 Gms Mixture. H_2O.	$(CH_3)_2CO$.	C_6H_5OH.
92	0	8	18.4	34.1	47.5
92.3	1.7	6	17.2	25.8	57
91	4	5	17.9	81.1	64
88.4	7.6	4	19.1	12.9	68
81	15	4	21.1	9.9	69
70.9	23.1	6	22.6	7.4	70
62.1	28.9	9	25.2	4.6	70.2
51.6	34.9	13.5	27.1	2.3	70.6
39.8	40.2	20	28.7	1.3	70
28.9	43.1	28	30	0.5	69.5
21.8	40.2	38			

Results at 80°.

Gms per 100 Gms. Mixture. H_2O.	$(CH_3)_2CO$.	C_6H_5OH.
83.3	3.7	13
82.9	7.1	10
74.7	13.8	11.5
61.8	20.2	18
52.5	24.5	23
40.6	27.4	32
32.2	21.8	46
33.4	15.6	51
35.4	11.6	53
40.5	7.5	52
49.7	4.3	46
62.7	2.8	34.5

SOLUBILITY OF PHENOL IN BENZENE AND IN PARAFFIN.
(Schweissinger, 1884–85.)

Solvent.	Gms C_6H_5OH per 100 Gms. Solvent at: 16°.	21°.	25°.	43°.
Paraffin	1.66	...	...	5
Benzene	2.5	8.33	10	100

Data for equilibrium in systems composed of phenol, water and each of the following compounds are given by Timmermans (1907): NaCl, KCl, KBr, KNO_3, K_2SO_4, $MgSO_4$, tartaric acid, salicylic acid, succinic acid and sodium oleate.

Miscibility of Aqueous Alkaline Solutions of Phenol with Several Organic Compounds Insoluble in Water.

(Scheuble, 1907.)

To 5 cc. portions of aq. KOH solution (250 gms. per liter) were added the given amounts of the aq. insoluble compound from a buret and then the phenol, dropwise, until solution occurred. Temperature not stated.

Composition of Homogeneous Solutions.

cc. Aq. KOH.	cc Aq Insol Cmpd	Gms Phenol.
5	2 (= 1.64 gms.) Octyl * Alcohol	2.6
5	5 (= 4.1 gms.) " "	3.9
5	2 (= 1.74 gms.) Toluene	4.9
5	3 (= 2.61 gms.) Toluene	6.7
5	2 (= 1.36 gms.) Heptane	15

* = the normal secondary octyl alcohol, *i e*, the so-called capryl alcohol, $CH_3(CH_2)_5.CH(OH)CH_3$.

Solubility of Phenol in Aqueous Solutions of Dextro Tartaric Acid and of Racemic Acid.

(Schreinemakers, 1900.)

In 5.093% Acid.

t°.	Gms Phenol per 100 Gms. Aq. Acid Layer.	Gms Phenol per 100 Gms. Phenol Layer
30	7.5	72.5
50	10.5	65.5
60	14.5	58
65	19.5	53
67.5	25	48.5
69*	47.5	

In 19.34% Acid.

t°.	Gms. Phenol per 100 Gms. Aq Acid Layer	Gms. Phenol per 100 Gms. Phenol Layer.
50	10	77
60	12.5	72
70	19	64
75	29	56
77*	47	

In 40.9% Acid.

t°.	Gms. Phenol per 100 Gms Aq Acid. Layer.	Gms. Phenol per 100 Gms Phenol Layer.
70	13	...
80	16.5	77
85	20	74
90	26.5	71
95	39	63.5
97*	54	

* Critical temperature.

Identical results were obtained with the dextro and racemic acids, showing that both have exactly the same influence on the formation of layers in the system water-phenol.

Distribution of Phenol between:

Amyl Alcohol and Water at 25°.

(Herz and Fischer — Ber. 37, 4747, '04.)

Millimols Phenol per 10 cc Alcoholic Layer.	Millimols Phenol per 10 cc Aqueous Layer.	Gms. Phenol per 100 cc. Alcoholic Layer.	Gms. Phenol per 100 cc. Aqueous Layer.
0.75	0.047	0.705	0.0441
0 9	0.05	0.846	0 047
1.1	0.07	1.035	0.066
2.6	0.16	2.445	0 150
54.1	3.83	50.88	3 601
56.3	3 9	52.93	3.667

Benzene and Water at 20°.

(Vaubel — J. pr. Ch. [2] 67, 476, '03.)

Volumes of Solvents used per 1 Gm. Phenol	Gms. Phenol in H_2O Layer.	Gms. Phenol in C_6H_6 Layer
50 cc. H_2O + 50 cc. C_6H_6	0.286	0.714
" + 100 cc. "	0.1188	0.8212
" + 150 cc. "	0.0893	0.9107
" + 200 cc. "	0.0893	0.9107

Distribution of Phenol between Water and Benzene at 20°.

(Philip and Bramley, 1915.)

Gms. Phenol per Liter. Aq. Layer, *a*.	Gms. Phenol per Liter. C_6H_6 Layer, *b*.	Ratio $\frac{b}{a}$.
0.945	2.073	2.194
0.888	1.944	2.189
0.711	1.553	2.184
0.594	1.293	2.176
0.475	1 036	2.181
0.356	0.7736	2.173
0.238	0.5177	2.175
0.119	0.2594	2.180
0.0601	0.1314	2.189

Results are also given for the effect of NaCl, KCl and of LiCl upon the above distribution.

DISTRIBUTION OF PHENOL BETWEEN WATER AND BENZENE AND BETWEEN AQUEOUS K_2SO_4 SOLUTIONS AND BENZENE AT 25°.

(Rothmund and Wilsmore — Z. physik. Ch. 40, 623, '02.)

NOTE. — The original results, which are given in terms of gram mols. per liter, were calculated to grams per liter, and plotted on cross-section paper. The following figures were read from the curves obtained.

Between H_2O and C_6H_6. Grams C_6H_5OH per Liter of: H_2O Layer.	C_6H_6 Layer.	Effect of K_2SO_4 upon the Distribution. Gms. K_2SO_4 per Liter Aq. Solution.	(1) Gms. C_6H_5OH per Liter of: Aq. Layer.	(1) C_6H_6 Layer.	(2) Gms. C_6H_5OH per Liter of: Aq. Layer.	(2) C_6H_6 Layer.
5	10	1.36	17.08	59.96	9.52	26.28
10	28	2.72	16.92	60.63	9.50	26.38
15	52	5.44	16.85	60.92	9.46	26.55
20	84	10.89	16.44	62.73	9.35	27.06
25	128	21.79	15 89	65.19	9.09	28.27
30	200	43 59	14 85	69.71	8.68	30.21
35	300	87.18	12.92	78.00	7.79	34.38
40	410					
45	520					
50	610					

(1) First series. (2) Second series.

EQUILIBRIUM IN THE SYSTEM PHENOL, BENZENE AND WATER AT 25°.

(Horiba, 1914-1916.)

Gms per 100 Gms Sat Sol. C_6H_5OH.	C_6H_6	H_2O.	Solid Phase.
81.06	18 94	0	C_6H_5OH
89.78	7.92	2.30	"
92.31	4.07	3.62	"
95.14	0	4.86	"

The results for the conjugated liquid layers are as follows:

Upper Layer. Gms. per 100 Gms of the Liquid. C_6H_5OH.	C_6H_6	H_2O.	Lower Layer. Gms per 100 Gms. of the Liquid C_6H_5OH.	C_6H_6	H_2O
0	99.95	0.05	0	0.198	99.802
4.78	94.98	0.24	1.43	0.21	98.36
17.36	81.83	0.81	2.80	0 21	96.99
21.15	77.22	1.63	3.01	0.21	96.77
28.01	69.81	2.18	3.35	0.21	96.44
44.39	50.56	5.05	4.07	0.19	95.74
55.80	36.13	8.07	4.58	0.19	59.23
74.5	3	22.5	5.65	0.17	94.18
70.70	0	29.29	8.195	0	91.805

Data for this system are also given by Rózsa (1911).

The coefficient of distribution of phenol between olive oil and water at 25°, conc. in oil ÷ conc. in H_2O, is given by Boeseken and Waterman (1911) as greater than 9 and less than 10.3. The figure was obtained by dividing the solubility of phenol in olive oil by the solubility in water, each being determined separately. Results for this system are also given by Reichel (1909).

According to Greenish and Smith (1903), 100 cc. of olive oil dissolve about 50 gms. of phenol at 15.5°. These authors report that 100 cc. of glycerol dissolve about 300 gms. of phenol at 15.5°.

Distribution of Phenol between Water and Carbon Tetra Chloride at 20°.

(Vaubel — J. pr. Ch. [2] 67, 476, '03.)

Gms. Phenol Used.	Volumes of Solvents.	Grams Phenol in: H_2O Layer.	Grams Phenol in: CCl_4 Layer.
1	50 cc. H_2O + 10 cc. CCl_4	0.8605	0.1285
1	" + 20 cc. "	0.7990	0.1900
1	" + 30 cc. "	0.7275	0.2615
1	" + 50 cc. "	0.6435	0.3455
1	" + 100 cc. "	0.4680	0.5210
1	" + 150 cc. "	0.3645	0.6245
1	" + 200 cc. "	0.3240	0.6650

Distribution of Phenol between Water and Organic Solvents at 25°.

(Herz and Rathmann, 1913)

Results for:

H_2O and Chloroform. Mols C_6H_5OH per Liter. H_2O Layer.	$CHCl_3$ Layer.	H_2O and Carbon Tetrachloride. Mols C_6H_5OH per Liter H_2O Layer.	CCl_4 Layer	H_2O and Tetrachlor Ethane. Mols C_6H_5OH per Liter H_2O Layer.	$C_2H_2Cl_4$ Layer.
0.0737	0.254	0 0605	0.0247	0.023	0.061
0.163	0.761	0 140	0.072[illegible]	0.0345	0.094
0.211	1.27	0.213	0.141	0.081	0 265
0.330	3.36	0.355	0.392	0.114	0.406
0.436	5.43	0.489	1.47	0.151	0.617
		0.525	2.49	0.155	0.651

H_2O and Pentachlor Ethane. Mols. C_6H_5OH per Liter. H_2O Layer	C_2HCl_5 Layer.	H_2O and Trichlor Ethylene. Mols C_6H_5OH per Liter H_2O Layer.	$CHClCCl_2$ Layer.	H_2O and Tetrachlor Ethylene. Mols C_6H_5OH per Liter. H_2O Layer	CCl_2CCl_2 Layer.
0.0420	0.0495	0.044	0.046	0.0653	0.0277
0.0866	0.110	0.101	0.107	0.143	0.0650
0.150	0.226	0.180	0.236	0 327	0.198
0.222	0.432	0.236	0.388	0.421	0.411
0.280	0.708	0.277	0.555	0 490	0.684
0.333	1.170	0.339	0.986		

Distribution of Phenol at 25° between:

(Herz and Fischer — Ber. 38, 1143, '05)

Water and Toluene. Millimols C_6H_5OH per 10 cc. $C_6H_5CH_3$ Layer.	H_2O Layer.	Grams C_6H_5OH per 100 cc. $C_6H_5CH_3$ Layer.	H_2O Layer.	Water and *m* Xylene. Millimols C_6H_5OH per 10 cc. $mC_6H_4(CH_3)_2$ Layer.	H_2O Layer.	Grams C_6H_5OH per 100 cc. $mC_6H_4(CH_3)_2$ Layer.	H_2O Layer.
1.244	0.724	1.169	0.681	1.610	1.071	1.514	1.007
3.047	1.469	2.865	1.381	4.787	2.726	4 501	2.563
4.667	2.200	4.389	2.068	12.210	5.168	11.22	4.860
6.446	2.861	6.061	2.691	22.718	6.994	21.36	6.577
14.960	4.750	14.07	4.467	34.827	8.124	32.75	7.64[illegible]
17.725	5.346	16.69	5.027	51.352	9.123	48.28	8.57[illegible]
47.003	7.706	44.20	7.246	77.703	10.050	73.07	9.45[illegible]
53.783	8.087	50.58	7.604				
90.287	9.651	84.89	9.074				

FREEZING-POINT DATA (Solubilities, see footnote, p. 1) ARE GIVEN FOR MIXTURES OF PHENOL AND EACH OF THE FOLLOWING COMPOUNDS:

Dimethylpyrone.	(Kendall, 1914a.)	Bromotoluene.	(Paterno and Ampola, 1897.)
Phenylhydrazine.	(Cuisa and Bernardi, 1910.)	*o* Toluidine.	(Kremann, 1906.)
Picric Acid.	(Philip, 1903; Kremann, 1904.)	*p* Toluidine.	(Kremann, 1906; Philip, 1903.)
Picric Acid+Other Cm'p'ds.	(Kremann, '04)	Urea	(Kremann & Rodenis, 1906; Philip, 1903.)
Pyridine.	(Bramley, 1916; Hatcher & Skirrow, 1917.)	Methyl Urea.	(Kremann, 1910.)
Quinoline.	(Bramley, 1916)	*as* Dimethyl Urea.	"
Resorcinol.	(Jaeger, 1907.)	*s* Dimethyl Urea.	"
Sulfuric Acid.	(Kendall and Carpenter, 1914.)	Urethan.	(Mascarelli & Pestalozza, 1908, 1909.)
Thymol.	(Paterno and Ampola, 1897.)	*p* Xylene.	(Paterno and Ampola, 1897.)
		m Xylidene.	(Kremann, 1906.)

PHENOLATE of Phenyl Ammonium.

SOLUBILITY IN WATER.

(Alexejew, 1886)

The determinations were made by the synthetic method (see p. 16). The results were plotted and the following figures read from the curve:

t°.	Gms Phenolate per 100 Gms. Aq. Layer.	Phenolate Layer.	t°.	Gms. Phenolate per 100 Gms. Aq. Layer.	Phenolate Layer.
10	3	94	110	9	76
30	4	93	120	12	69
50	5	91	130	17.5	60
70	6	87.5	140 crit. temp.	40	
90	7	83			

AminoPHENOLS. See last line p. 138.

s TribromoPHENOL $C_6H_2Br_3OH$.

Data for the solubility of mixtures of symmetrical tribromophenol and symmetrical trichlorophenol in diluted methyl alcohol at 25° are given by Küster and Würfel (1904–05). The results are presented in terms which are not clearly explained.

SOLUBILITY OF MIXTURES OF *s* TRIBROMO PHENOL AND *s* TRICHLORO PHENOL IN METHYL ALCOHOL AT 25°.

(Thiel, 1903; from Würfel, 1896)

Molecular per cent $C_6H_2OHBr_3$ In Solid.	In Solution.	*n* Solubility of $C_6H_2.OH.Cl_3$.	$C_6H_2.OH.Br_3$.	Total.
0	0	0.204	0	0.204
4.49	3.59	0.194	0.007	0.201
10.13	7.58	0.191	0.016	0.206
16.28	12.15	0.172	0.024	0.196
62.44	13.07	0.204	0.031	0.235
69.88	15.86	0.150	0.028	0.178
81.76	19.01	0.096	0.023	0.118
84.66	24.05	0.069	0.022	0.091
87.53	32.46	0.043	0.021	0.063
93.62	47.87	0.021	0.019	0.040
100.0	100.0	0.0	0.019	0.019

NitroPHENOLS $C_6H_4(OH)NO_2$ *o*, *m* and *p*.

100 gms. sat. solution in water contain 0.208 gm. *o* nitrophenol at 20°.
" " " " 2.14 gms. *m* " "
" " " " 1.32 " *p* " " (Vaubel, 1895.)

F.-pt. data for mixtures of *m* nitrophenol and water and for *p* nitrophenol and water are given by Bogojawlewsky, Winogradow, and Bogolubow (1906).

NitroPHENOLS $C_6H_4(OH).NO_2$ *o, m* and *p*.

SOLUBILITY OF EACH SEPARATELY IN WATER. (Sidgwick, Spurrell and Davies, 1915.)

t°.	Gms. per 100 Gms. Sat. Sol. Ortho	Meta.	Para.	t°.	Gms per 100 Gms Sat Sol. Ortho	Meta.	Para.
40	0.330*	3.02*	3.28	100	1.078	...	...
50	0.388	3.68	4.22	110	1.37	...	...
60	0.463	4.54	5.53	120	1.59	...	...
70	0.560	5.80	7.50	120	1.91	...	...
80	0.685	7.90	10.85	140	2.32	...	..
90	0.856	11.69	21.2	150	2.90	...	...
92.8 crit. t.	...	...	∞	160	3.75		
98.7 crit. t.	...	∞	...	200+ crit. t.	∞		

* in above table indicates that a solid phase is present.

The above determinations were made by the synthetic method. M. pt. of *o* = 44.9°; of *m* = 95.1°, of *p* = 113.8°. Triple pt. for *o* = 43.5° at conc. 99.48 and 0.35; for *m* = 41.5° at conc. 74 and 3.16; for *p* = 39.6° at conc. 71.2 and 3.26.

One liter sat. solution in water contains 3.89 gms. *o* nitrophenol at 48°.

One liter sat. solution in 1.0 *n* *o* $C_6H_4(ONa)NO_2$ contains 9.6 gms. *o* nitrophenol at 48°. (Sidgwick, '10.)

SOLUBILITY OF *o* NITROPHENOL IN LIQUID CARBON DIOXIDE. (Büchner, 1905-6.)

t°.	Gms *o* $C_6H_4(OH)NO_2$ per 100 Gms. Sat Sol.	t°	Gms *o* $C_6H_4(OH)NO_2$ per 100 Gms. Sat. Sol.
−52	1.9	12.5	10
−40	2.5	14	21.2
−20	3.8	15	33.8
0	5.2	16	48.5
+10	7.7	20	60.7

100 gms. 95% formic acid dissolve 16.06 gms. *o* $C_6H_4(OH)NO_2$ at 20.8°. (Aschan, '13.)
100 gms. 95% formic acid dissolve 23.44 gms. *p* $C_6H_4(OH)NO_2$ at 18.6°. "

One liter of sat. solution of the pale yellow form of *p* nitrophenol in benzene, contains 7.1 gms. *p* $C_6H_4(OH)NO_2$ at 5°, determined by the f.-pt. method. (Sidgwick, 1915)

SOLUBILITY OF THE THREE NITROPHENOLS, SEPARATELY, IN TOLUENE, BROMOBENZENE AND IN ETHYLENE DIBROMIDE. (Sidgwick, Spurrell and Davies, 1915.)

t°.	Gms. *o* $C_6H_4(OH)NO_2$ per 100 Gms Sat Sol In $C_6H_5CH_3$.	In C_6H_5Br.	In $C_2H_4Br_2$.	t°.	Gms. *p* $C_6H_4(OH)NO_2$ per 100 Gms Sat. Sol. In $C_6H_5CH_3$.	In C_6H_5Br.	In $C_2H_4Br_2$.
15	46.9	...	40	70	18.5	...	31
20	55.2	48.8	47.8	80	28.1	32.7	52
25	64.6	57.7	56.8	90	54.4	59.7	73.2
30	74.6	67.2	67.2	100	79.6	80.6	88.5
35	84.5	78.3	79	110	96.3	96.3	98
40	93.1	89.7	90.6				

t°.	Gms *m* $C_6H_4(OH)NO_2$ per 100 Gms. Sat. Sol. in $C_6H_5CH_3$.	t°.	Gms. *m* $C_6H_4(OH)NO_2$ per 100 Gms Sat Sol. in $C_6H_5CH_3$.	t°.	Gms. *m* $C_6H_4(OH)NO_2$ per 100 Gms. Sat. Sol. in $C_6H_5CH_3$.
39.6	4.63	64.8	16.44	78.5	70.50
45.8	6	67.7	20.26	82.3	79.57
48.9	7.03	71.5	33.16	88.8	91.43
54	9.11	74.5	46.93	95.1	100
58	11.28	75.7	57.71		

DiNitro PHENOL $C_6H_3.OH.(NO_2)_2$.

100 gms. abs. methyl alcohol dissolve 6.3 gms. $C_6H_3.OH.(NO_2)_2$ at 19.5°.
100 gms. abs. ethyl alcohol dissolve 3.9 gms. $C_6H_3.OH.(NO_2)_2$ at 19.5°. (de Bruyn, '92.)

FREEZING-POINT DATA (Solubility, see footnote, p. 1) ARE GIVEN FOR THE FOLLOWING MIXTURES CONTAINING SUBSTITUTED PHENOLS.

o Bromophenol + *p* Bromophenol.	(Holleman and Rinkes, 1911.)
o Chlorophenol + *p* Chlorophenol.	" "
o Iodophenol + *p* Iodophenol.	" "
s Tribromophenol + *s* Trichlorophenol.	(Küster and Würfel, 1904–05.)
2.4.6 Tribromophenol + Acetyl tribromophenol.	(Boeseken, 1912.)
o Chlorophenol + Quinoline.	(Bramley, 1916.)
" + Pyridine.	"
o Nitrophenol + Acetyl *o* Nitrophenol.	(Boeseken, 1912.)
o Nitrophenol + *α* Dinitrophenol.	(Crompton and Whitely, 1895.)
" + *p* Toluidine.	(Pawlewski, 1893; Philip, 1903.)
p Nitrophenol + *p* Nitrosophenol.	(Jaeger, 1908.)
Each of *o*, *m* and *p* Nitrophenol + Dimethylpyrone.	(Kendall, 1914a.)
" " " + Picric Acid.	(Kremann and Rodenis, 1906.)
" " " + Sulfuric Acid.	(Kendall and Carpenter, 1914.)
" " " + Urea.	(Kremann and Rodenis, 1906.)
2.4 Dinitrophenol + Dimethylpyrone.	(Kendall, 1914a.)

PHENOLPHTHALEIN $(C_6H_4OH)_2CO.C_6H_4CO$.

100 gms. H_2O	dissolve	0.0175 gm.	phenolphthalein at 20°.	(Acree and Slagle, 1909.)
" "	"	0.04 "	" at 20–25°.	(Dehn, '17.)
" Pyridine	"	796. gms.	" "	"
" aq. 50% pyridine	"	300 "	" "	"

PHENYL ALANINE *α* $C_6H_5NHCH(CH_3)COOH$.

Data for the solubility of phenyl alanine in aqueous salt solutions at 20° are given by Würgler (1914) and Pfeiffer and Würgler (1916).

PHENYLENE DIAMINES *o*, *m*, and *p*. $C_6H_4(NH_2)_2$.

SOLUBILITY IN WATER AT 20°. (Vaubel, 1895.)

100 cc. sat. solution contain 23.8 gms. *m* $C_6H_4(NH_2)_2$, d_{20} of sat. sol. = 1.0317.
100 cc. sat. solution contain 3.7 gms. *p* $C_6H_4(NH_2)_2$, d_{20} of sat. sol. = 1.0038.

RATIO OF DISTRIBUTION BETWEEN WATER AND BENZENE AT 25°.
(Farmer and Warth, 1904.)

Results for *o* Phenylene Diamine. Gms. *o* $C_6H_4(NH_2)_2$ per: 50 cc. C_6H_6.	1000 cc H_2O.	Ratio $\frac{\text{conc } C_6H_6}{\text{conc. } H_2O}$.	Results for *m* Phenylene Diamine. Gms *m* $C_6H_4(NH_2)_2$ per: 50 cc C_6H_6.	1000 cc H_2O.	Ratio $\frac{\text{conc } C_6H_6}{\text{conc. } H_2O}$.
0.0273	0.9818	0.556	0.0828	9.088	0.182
0.2040	7.5470	0.541	0.0463	5.260	0.176

PHENYL HYDRAZINE $C_6H_5NH.NH_2$.

RECIPROCAL SOLUBILITY OF PHENYLHYDRAZINE AND WATER, DETERMINED BY THE FREEZING-POINT METHOD. (Blanksma, 1910.)

t°.	Gms $C_6H_5NH.NH_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms $C_6H_5NH.NH_2$ per 100 Gms. Sat. Sol.	Solid Phase.
0	0	Ice	19.8	60.1	$C_6H_5NH.NH_2.\frac{1}{2}H_2O$
−0.3	2.2	"	20.4	64.2	"
−0.6	3.9	"	21.8	75	"
−0.7	4.6	" + $C_6H_5NH.NH_2.\frac{1}{2}H_2O$	23	79.2	"
+1	4.7	$C_6H_5NH.NH_2.\frac{1}{2}H_2O$	24.2	83.7	"
7	6	"	26.1	91	"
11.6	7	"	26.2	92.3	"
15	8	"	25.7	93.7	"
16.8	9.6	"	23.2	97.2	"
19.6	10.9	"	17	98.8	"
			16.6	99	" + $C_6H_5NH.NH_2$
			19.6 m. pt.	100	$C_6H_5NH.NH_2$

Between the concentrations 10.9 and 60.1, two liquid layers are formed. See p. 487.

RECIPROCAL SOLUBILITY OF PHENYL HYDRAZINE AND WATER. (Con.)

The temperatures of separation into two liquid layers of mixtures containing from 10.9 to 60 per cent $C_6H_5NH.NH_2$, are:

t° of Separation.	Gms. $C_6H_5NH.NH_2$ per 100 Gms. Mixture.	t° of Separation.	Gms. $C_6H_5NH.NH_2$ per 100 Gms. Mixture.	t° of Separation.	Gms. $C_6H_5NH.NH_2$ per 100 Gms. Mixture.
19.8	11.6	54.6	29.7	50.6	48.9
34	13.8	55.1	31.4	50	51.2
45	16.5	55.2 crit. t.	33.6	46	53.5
49.4	18.7	55.2	36.9	44.2	54.7
52.4	21.9	55	39.3	39.6	56.7
54	25.2	54	41.7	24	59.5
54.4	28.3	52.6	46	19.8	60.1

Additional data for concentrations of $C_6H_5NH.NH_2$ above 60 per cent, are given by Oddo (1913).

Benzoyl **PHENYL HYDRAZINE** $C_6H_5NH.NHC_7H_5O$.

SOLUBILITY IN AQUEOUS ALCOHOL AT 25°.
(Holleman and Antusch, 1894)

Vol. % Alcohol.	Gms. Hydrazine per 100 g. Solvent.	Sp. Gr. Solutions.	Vol. % Alcohol.	Gms. Hydrazine per 100 g. Solvent.	Sp. Gr. Solutions.
100	2.39	0.793	80	1.59	0.859
95	2.43	0.814	70	1.08	0.884
93	3	0.822	55	0.51	0.917
90	2.26	0.831	40	0.16	0.946

The above results give an irregular curve. See remarks under α acetnaphthalide, p.13.

Phthalyl **PHENYL HYDRAZIDE** $C_6H_4\left\langle{CO \atop CO}\right\rangle N.N\left\langle{H \atop C_6H_5}\right.$

Phthalyl **PHENYL** Methyl **HYDRAZIDE** $C_6H_4\left\langle{CO \atop CO}\right\rangle N.N\left\langle{CH_3 \atop C_6H_5}\right.$

Very careful determinations of the solubilities of the enantrotropic forms of these two compounds in alcohol, chloroform, ethyl acetate, acetone, benzene and in methyl alcohol are given by Chattaway and Lambert (1915). See also p. 312.

Acetone **PHENYL HYDRAZONE** $(CH_3)_2C.N_2HC_6H_5$.

DATA FOR THE SYSTEM ACETONE PHENYL HYDRAZONE + WATER ARE GIVEN BY BLANKSMA (1912).

The following results were obtained for the solubility of $(CH_3)_2C.N_2.HC_6H_5.H_2O$ in water.

t°.	Gms. $(CH_3)_2C.N_2HC_6H_5$ per 100 cc Solution.	Solid Phase.
0	0.090	$(CH_3)_2C.N_2HC_6H_5.H_2O$
15	0.187	"
32.8	0.412	"

Dibromo**PHENYL SELENIDE** and **TELLURIDE** $(C_6H_5)_2SeBr_2,(C_6H_5)_2TeBr_2$.

Data for the solubility of mixtures of dibromophenyl selenide and dibromophenyl telluride in benzene at 21° are given by Pellini (1906).

PHLOROGLUCINOL 1.2.3 $C_6H_3(OH)_3.2H_2O$.

100 gms. H_2O	dissolve	1.13 gms. phloroglucinol at 20-25°.	(Dehn, '17)
" pyridine	"	296 " " "	"
" aq. 50% pyridine	"	134 " " "	"

PHOSPHO MOLYBDIC ACID $P_2O_5.20MoO_3.52H_2O$.

SOLUBILITY IN ETHER. (Parmentier, 1887.)

t°.	0°.	8.1°.	19.3°.	27.4°.	32.9°.
Gms. Acid per 100 gms. Ether	80.6	84.7	96.7	103.9	107.9

PHOSPHORUS P. (yellow)

SOLUBILITY IN BENZENE.

(Christomanos — Z. anorg. Ch. 45, 136, '05.)

t°.	Gms. P per 100 Gms. C_6H_6.	Sp. Gr. of Solution.	t°.	Gms. P per 100 Gms. C_6H_6.	Sp. Gr. of Solution.	t°.	Gms. P per 100 Gms. C_6H_6
0	1.513	...	23	3.399	0.8875	50	6.80
5	1.99	...	25	3.70	0.8861	55	7.32
8	2.31	0.8990	30	4.60	...	60	7.90
10	2.4	0.8985	35	5.17	...	65	8.40
15	2.7	0.894	40	5.75	...	70	8.90
18	3.1	0.892	45	6.11	...	75	9.40
20	3.2	0.890				81	10.03

SOLUBILITY OF PHOSPHORUS IN ETHER.

(Christomanos.)

t°.	Gms. P per 100 Gms. $(C_2H_5)_2O$.	Sp. Gr. of Solutions.	t°.	Gms. P per 100 Gms. $(C_2H_5)_2O$.	Sp. Gr. of Solutions.	t°.	Gms. P per 100 Gms. $(C_2H_5)_2O$.
0	0.434	...	15	0.90	0.723	28	1.60
5	0.62	...	18	1.01	0.719	30	1.75
8	0.79	0.732	20	1.04	0.718	33	1.80
10	0.85	0.729	23	1.12	0.722	35	2.00
			25	1.39	0.728		

SOLUBILITY OF YELLOW PHOSPHORUS IN SEVERAL SOLVENTS AT 15°.

(Stich, 1903.)

Solvent.	Gms. P per 100 Gms. Solution.
Almond Oil	1.25
Oleic Acid	1.06
Paraffin	1.45
Water	0.0003
Acetic Acid (96%)	0.105

SOLUBILITY OF PHOSPHORUS IN CARBON DISULFIDE.

(Cohn and Inouye, 1910)

t°.	Gms P per 100 Gms. Sat Sol.	t°.	Gms P per 100 Gms. Sat Sol.	t°.	Gms. P per 100 Gms. Sat. Sol.
−10	31.40	−3.5	66.14	0	81.27
−7.5	35.85	−3.2	71.72	+5	86.3
−5	41.95	−2.5	75	10	89.8

The above determinations were made with very great care. The authors show that the previous determinations of Giran (1903) are inaccurate.

100 gms. alcohol ($d = 0.799$) dissolve 0.312 gm. P, cold, and 0.416 gm., hot. (Büchner)

100 gms. glycerol ($d_{15} = 1.256$) dissolve 0.25 gms. P at 15–16°. (Ossendowski, 1907.)

Red phosphorus is completely insoluble in turpentine even up to 270° provided the determination is made without access of air (sealed tube). If air is not excluded a portion of the red phosphorus may be converted to yellow phosphorus which would dissolve. (Colson, 1907.)

RECIPROCAL SOLUBILITY OF PHOSPHORUS AND SULFUR, DETERMINED BY THE SYNTHETIC (Sealed Tube) METHOD.

(Giran, 1906)

(Mixtures of P and S were sealed in small tubes and first heated to about 200° to cause combination. They were then cooled to the solidification point and gradually heated to the temperature at which the last crystal disappeared. The following results, which were read from the diagram, show the eutectics and maxima of the curves.)

Eutectics.			Maxima of Curves.		
t°.	Mols. % S in Mixture.	Solid Phase.	t°.	Mols % S in Mixture.	Solid Phase.
−40	33.5	$P_4S_3+P_2$	+167	43.6	P_4S_3
+46	50	$P_4S_3+P_2S_3$	296	60.8	P_2S_3
230	67.5	$P_2S_3+P_2S_5$	272	72.1	P_2S_5
243	75	$P_2S_5+PS_6$	314	86.1	PS_6

Additional data for this system are given by Boulouch (1902 and 1906) and by Helff, 1893.

PHOSPHORUS SULFIDES P_4S_3, P_4S_7, P_4S_{10}.

SOLUBILITY IN CARBON DISULFIDE, BENZENE, AND IN TOLUENE.

(Stock, 1910)

t°.	Gms. P_4S_3 per 100 Gms.: CS_2.	C_6H_6.	$C_6H_5CH_3$.	Gms P_4S_7 per 100 Gms. CS_2.	Gms P_4S_{10} per 100 Gms. CS_2.
−20	11.1	...	...	...	0.083
0	27	...	...	0.005	0.182
+17	100	2.5	3.125	0.0286	0.223
80	...	11.1	...	...	...
110	...	...	15.4	...	...

PHOSPHORIC ACID (ortho) H_3PO_4.

SOLUBILITY IN WATER. (Smith and Menzies, 1909)

(The sat. solutions were analyzed by titration. The mixtures were constantly stirred for at least two hours.)

t°.	Gms. H_3PO_4 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms H_3PO_4 per 100 Gms. Sat Sol.	Solid Phase.
−81*	62.9	Ice+$2H_3PO_4.H_2O$	24.38	94.80	$10H_3PO_4.H_2O$
−16.3	76.7	$2H_3PO_4.H_2O$	24.40	94.84	"
+ 0.5	78.7	"	24.81	94.95	"
14.95	81.7	"	25.41	95.26	"
24.03	85.7	"	25.85	95.54	"
27	87.7	"	26.2*	...	" +H_3PO_4
29.15	90.5	"	26.23	95.90	H_3PO_4
29.35†	91.6	"	27.02	95.98	"
28.5	92.5	"	29.42	96.15	"
27	93.4	"	29.77	96.11	"
25.4	94.1	"	37.65	97.80	"
23.5*	...	" +$10H_3PO_4.H_2O$	39.35	98.48	"
24.11	94.78	$10H_3PO_4.H_2O$	42.30†	100	"

* Eutec. † M pt.

NOTE. — The results of Giran (1908), determined by the freezing-point method, are shown to be erroneous, due to supercooling which would result from failure to induce crystallization by inoculation.

F.-pt. data for mixtures of phosphoric and phosphorus acids are given by Rosenheim, Stadler and Jakobsohn (1906).

PyroPHOSPHORIC ACID $H_4P_2O_7$.

SOLUBILITY IN WATER. (Giran, 1908; see note on preceding page.)

t°.	Gms. $H_4P_2O_7$ per 100 Gms. Sat. Sol.	Solid Phase.
−75	59	Ice $+H_4P_2O_7.1\frac{1}{2}H_2O$
+26 m. pt.	86.8	$H_4P_2O_7.1\frac{1}{2}H_2O$
23	88.8	" $+H_4P_2O_7$
61 m. pt.	100	$H_4P_2O_7$

HypoPHOSPHORIC ACID $H_2PO_3.H_2O$.

100 gms. sat. solution in water contain 81.8 gms. H_2PO_3 at the m. pt., 62°, of the hydrated compound, $H_2PO_3.H_2O$. (Rosenheim and Pritze, 1908.)

PHTHALIC ACIDS $C_6H_4(COOH)_2$, *o*, *m* and *p*.

SOLUBILITY OF EACH IN WATER. (Vaubel, 1895, 1899.)

Acid.	t°.	Gms per 100 Gms. Solution.
o Phthalic Acid	14	0.54
m = Isophthalic Acid	25	0.013
p = Terephthalic Acid	...	almost insoluble

MELTING TEMPERATURES OF MIXTURES OF *o* PHTHALIC ACID AND WATER.
(Flaschner and Rankin, 1910)

(The determinations were made by the sealed tube method of Alexejew.)

Wt. % Acid	14.4	28.2	39.6	49.3	75	100
Saturation Temp.	97°	111.5°	121.2°	130°	162°	231°
Unstable boundary	...	...	...	27°	84°	...

SOLUBILITY OF *o* PHTHALIC ACID IN ALCOHOL AND IN ETHER AT 15°.
(Bourgoin, 1878)

Solvent.	Gms. $C_6H_4(COOH)_2$ *o* per 100 Gms. Solution.	Gms. $C_6H_4(COOH)_2$ *o* per 100 Gms. Solvent.
Absolute Alcohol	9.156	11.70
90 per cent Alcohol	10.478	10.08
Ether	0.679	0.684

SOLUBILITY OF *o* PHTHALIC ACID IN ALCOHOLS. (Timofeiew, 1894.)

Alcohol.	t°.	Gms *o* $C_6H_4(COOH)_2$ per 100 Gms. Sat. Sol.	Alcohol.	t°.	Gms. *o* $C_6H_4(COOH)_2$ per 100 Gms. Sat. Sol.
Methyl Alcohol	− 2	15.1	Ethyl Alcohol	21.4	11.65
" "	+19	19.5	Propyl Alcohol	− 3	3.42
" "	+21.4	20.4	" "	+19	5.27
Ethyl Alcohol	− 2	8.2	" "	22	5.54
" "	+19	11	" "	23	5.70

DISTRIBUTION OF *o* PHTHALIC ACID AND OF *m* PHTHALIC ACID (ISOPHTHALIC) BETWEEN WATER AND ETHER AT 25°. (Chandler, 1908)

Results for *o* Phthalic Acid. Mols. *o* $C_6H_4(COOH)_2$ per Liter: H_2O Layer, *a*.	Ether Layer, *b*.	Ratio $\frac{a}{b}$.	Ratio for Union-ized Acid.	Results for *m* Phthalic Acid. Mols. *m* $C_6H_4(COOH)_2$ per Liter: H_2O Layer, *a*.	Ether Layer, *b*.	Ratio $\frac{a}{b}$.	Ratio for Union-ized Acid.
0.0261	0.0322	0.809	0.637	0.000398	0.0485	0.0821	0.0359
0.0131	0 0150	0.873	0.645	0.000272	0.0288	0.0943	0.0352
0.0085	0.0091	0.932	0.667	0.000263	0.0279	0.0944	0.0350
0.0056	0.0056	1.006	0.635	0 000252	0.0266	0.0949	0.0341

Ratio of solubilities of Phthalic acids in olive oil and water at 25°.
(Boeseken and Waterman, 1911, 1912.)

o Phthalic acid, solubility in oil ÷ solubility in H_2O = 0.01.

p Phthalic acid (Terephthalic), solubility in oil ÷ solubility in H_2O = 9.52.

100 gms. 95% formic acid dissolve 0.55 gm. *p* phthalic acid (Terephthalic) at 20.2°. (Aschan, 1913.)

NitroPHTHALIC ACIDS *o* and *m* (Iso) $C_6H_3(NO_2)(COOH)_2$.

SOLUBILITY OF THE SEVERAL NITRO PHTHALIC ACIDS IN WATER AT 25°.
(Holleman and Huisinga, 1908.)

Acid.	M. pt.	Gms Acid per 100 Gms. Sat. Solution.
α Nitro Ortho Phthalic Acid	220	2.048
β " " " "	164–166	very soluble
Symmetrical Nitro Iso Phthalic Acid (anhy.)	255–256	0.220
" " " " (hydrated)	255–256	0.157
Asymmetrical " " "	245	0.967
Vicinal " " "	300	0.216

The authors also give several tables showing the solubility of one of the above compounds in aqueous solutions of another. These data are made the basis of an ingenious solubility method for determining the composition of unknown mixtures of these compounds.

PHTHALIC ANHYDRIDE $C_6H_4<{CO \atop CO}>O$.

SOLUBILITY IN WATER.
(van der Stadt, 1902)

All determinations, except first three, made by the Synthetic Method. See p. 16.

t°.	Gms. $C_8H_4O_3$ per 100 Gms. Water	Solution	Mol per cent $C_8H_4O_3$.	t°.	Gms $C_8H_4O_3$ per 100 Gms Water.	Solution.	Mol. per cent $C_8H_4O_3$
0	0.00295	0.00295	0.00036	189.5	1076	91.66	56.73
25	0.6194	0.6150	0 0754	188.8	1265	92.68	60.63
50	1.630	1.604	0.198	187.1	1474	93 65	64.22
135.9	94.3	48.54	10.30	181.8	2332	95 88	73.95
165.4	210	67.75	20 36	176.2	3334	97.07	80.23
179.4	319.3	76.13	27.98	169.4	5745	98.28	87.49
186.2	449.6	81.81	35.37	130.9	37570	99.72	97.89
189.6	546.1	84.50	39.93	131	83010	99.86	99.02
191	821.5	89.19	50	131.2	∞	100	100
190.4	863.4	89.62	51.24				

SOLUBILITY OF PHTHALIC ANHYDRIDE IN CARBON DISULFIDE.
(Arctowski, 1895; Etard, 1894)

t°.	Gms. $C_8H_4O_3$ per 100 Gms. Solution.	t°.	Gms $C_8H_4O_3$ per 100 Gms Solution.	t°.	Gms. $C_8H_4O_3$ per 100 Gms. Solution.
−112.5	0.013	+10	0.3	70	2.3
−93	0.013	20	0.7	90	3.7
−77.5	0.016	30	0.8	100	5
−40	0.03	40	1.2	120	8
−20	0.06	50	1.3	140	13.3
−10	0.10	60	1.7	160	20.7
0	0.20			180	30.2

100 gms. 95% formic acid dissolve 4.67 gms. phthalic anhydride at 19.8°. (Aschan, 1913.)

100 gms. pyridine dissolve 83.5 gms. phthalic anhydride at 20–25°. (Dehn, 1917.)

PHTHALIMIDE *o* $C_6H_4 < (CO)_2 > NH$.

100 gms. H_2O dissolve 0.06 gm. phthalimide at 20–25°. (Dehn, 1917.)
" pyridine " 14.15 gms. " " "
" aq. 50% pyridine " 7.74 " " " "

PHTHALONIC ACID $COOH.C_6H_4.CO.COOH.2H_2O$.

100 gms. sat. solution in water contain 64.4 gms. anhydrous acid at 15°, Sp. Gr. of sat. solution = 1.243. (Tcherniac, 1916.)

Amide of **PHTHALIDECARBOXYLIC ACID** $C_6H_4<\substack{CH(CONH_2)\\CO}>O$ (m. pt. 185.5°).

100 gms. H_2O dissolve 0.132 gm. of the acid at 16.2° and 5.7 gms. at b. pt. (Tcherniac, 1916.)

PHYSOSTIGMINE (Escrine) $C_{15}H_{21}N_3O_2$.

Water dissolves only traces of physostigmine. 100 gms. of a solvent composed of 3 gms. H_3BO_3 per 100 cc. of aq. 50% glycerol dissolve 2.5 gms. $C_{15}H_{21}N_3O_2$ at room temp. (Baroni and Borlinetto, 1911.)

PHYSOSTIGMINE SALICYLATE $C_6H_4(OH)COOH.C_{15}H_{21}N_3O_2$ and Physostigmine Sulfate $H_2SO_4(C_{15}H_{21}N_3O_2)_2$.

SOLUBILITY OF EACH IN WATER, ALCOHOL, ETC.
(U. S. P. VIII.)

Solvent.	t°.	Gms. per 100 Gms Solvent. Salicylate.	Sulfate.
Water	25	1.38	very soluble
Water	80	6.66	"
Alcohol	25	7.87	"
Alcohol	60	25	"
Chloroform	25	11.6	"
Ether	25	0.57	0.083

Methylphenyl **PICRAMIDES.**

SOLUBILITY IN ETHYL ALCOHOL AT 18°.
(Hantzsch, 1911)

100 cc. C_2H_5OH dissolve 0.32 gm. of the isomer melting at 108°.
100 cc. C_2H_5OH dissolve 0.42 gm. of the isomer melting at 128°.

PICRIC ACID $C_6H_2.OH.(NO_2)_3$ 1.2.4.6.

SOLUBILITY IN WATER.
(Dolinski — Ber. 38, 1836, '05; Findlay — J. Ch. Soc. 81, 1219, '02.)

t°.	Gms $C_6H_3N_3O_7$ per 100 Grams Solution.	Water.		t°.	Gms. $C_6H_3N_3O_7$ per 100 Grams Solution.	Water.	
0	0.67 (D.)	0.68 (D)	1.05 (F.)	60	2.77 (D.)	2.81 (D.)	3.17 (F.)
10	.80	0.81	1.10	70	3.35	3.47	3.89
20	1.10	1.11	1.22	80	4.22	4.41	4.66
30	1.38	1.40	1.55	90	5.44	5.72	5.49
40	1.75	1.78	1.98	100	6.75	7.24	6.33
50	2.15	2.19	2.53				

Dolinski does not refer to the previous determinations of Findlay.

100 gms. H_2O dissolve 1.525 gms. $C_6H_2.OH.(NO_2)_3$ at 30° and 1.868 gms. at 40°. (Karplus, 1907.)

100 gms. H_2O dissolve 1.45 gms. $C_6H_2.OH.(NO_2)_3$ at 20°. (Sisley, 1902.)

100 gms H_2O containing 5 gms. H_2SO_4 per liter, dissolve 0.61 gm. $C_6H_2OH(NO_2)_3$ at 20°. (Sisley, 1902.)

100 gms. ethyl alcohol dissolve 8.37 gms. $C_6H_2OH(NO_2)_3$ at 22°. (Timofeiew, 1894.)
100 gms. methyl alcohol dissolve 22.5 gms. $C_6H_2OH(NO_2)_3$ at 22°. "
100 gms. propyl alcohol dissolve 3.81 gms. $C_6H_2OH(NO_2)_3$ at 22°. "
100 gms. 95% formic acid dissolve 10.83 gms. $C_6H_2OH(NO_2)_3$ at 19.8°. (Aschan, 1913.)

Solubility of Picric Acid in Water and in Aqueous Salt Solutions at 25°.

(Levin — Z. physik. Ch. 55, 520, '06.)

One liter of aqueous solution contains 0.05328 gram mols. = 12.20 grams $C_6H_2.OH(NO_2)_3$ at 25°.

Gm. Mols. Salt per Liter.	Gram Mols. Picric Acid per Liter in Aq. Solutions of: NaCl.	$NaNO_3$.	Na_2SO_4.	LiCl.	Li_2SO_4.	NH_4Cl.
0.01	0.05524	0.05529	0.05604	0.05480	0.05661	0.05487
0.02	0.05559	0.05872	0.05872	0.05558	0.06053	0.05540
0.05	0.05729	0.06632	0.06632	0.05703	0.06691	0.05771
0.07	0.05862	0.07093	0.07093	0.05878	0.07013	0.05865
0.10	0.05902	0.07670	0.07670	0.06132	0.07437	...
0.50	0.0790	...	...	...	0.123	...
1.00	0.1180	...	...	...	0.149	...

Gm. Mols. Salt per Liter.	Grams Picric Acid per Liter in Aq. Solutions of: NaCl.	$NaNO_3$.	Na_2SO_4.	LiCl.	Li_2SO_4.	NH_4Cl.
0.01	12.66	12.67	12.83	12.55	12.97	12.57
0.02	12.74	13.45	13.45	12.74	13.87	12.69
0.05	13.12	15.19	15.19	13.06	15.33	13.22
0.07	13.43	16.25	16.25	13.47	16.06	13.44
0.10	13.52	17.57	17.57	14.05	17.04	...
0.50	18.09	...	...	...	28.18	...
1.00	26.98	...	...	...	34.14	...

Solubility in Aq. Cane Sugar.

Gm. Mols. Sugar per Liter.	Picric Ac. per Liter Solution. Gm. Mols.	Gms.	Sp. Gr. Solution.
0.10	0.05202	11.92	1.0122
0.25	0.04978	11.40	1.0319
0.50	0.0482	11.04	1.0654
1.00	0.0443	10.15	1.1294

Solubility in Aq. Grape Sugar.

Gm. Mols. Grape Sugar per Liter.	Picric Acid per Liter Sol. G. Mols.	Gms.
0.10	0.0530	12.14
0.25	0.0521	11.93
0.50	0.0509	11.66
1.00	0.0474	10.86

Solubility of Picric Acid in Absolute Alcohol.

(Behrend — Z. physik. Ch. 10, 265, '92.)

100 gms. sat. solution contain 5.53 grams $C_6H_3N_3O_7$ at 12.3°, and 5.92 grams at 14.8°. Sp. Gr. of the latter solution = 0.8255.

Solubility of Picric Acid in Benzene.

(Findlay.)

t°.	Gms. $C_6H_3N_3O_7$ per 100 Gms. C_6H_6.	Mols. $C_6H_3N_3O_7$ per 100 Mols. C_6H_6.	t°	Gms. $C_6H_3N_3O_7$ per 100 Gms. C_6H_6.	Mols. $C_6H_3N_3O_7$ per 100 Mols. C_6H_6.
5	3.70	1.26	38.4	26.15	8.88
10	5.37	1.83	45	33.57	11.40
15	7.29	2.48	55	50.65	17.21
20	9.56	3.25	58.7	58.42	19.83
25	12.66	4.30	65	71.31	24.20
26.5	13.51	4.60	75	96.77	32.92
35	21.38	7.26			

SOLUBILITY OF PICRIC ACID IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 25°.
(Stepanow, 1910.)

(The solutions were saturated by constant agitation at constant temperature. The picric acid in the saturated solutions was determined by evaporation and weighing. The solubility passes through a minimum.)

Mols. HCl per Liter.	$C_6H_2OH.(NO_2)_3$ per Liter. Mols.	Gms.	Mols. HCl per Liter.	$C_6H_2.OH.(NO_2)_3$ per Liter. Mols.	Gms.
0.25	0.0116	2.66	3.67	0.0068	1.55
0.50	0.0079	1.80	4.40	0.0082	1.87
0.75	0.0062	1.42	5.14	0.0098	2.26
1	0.0054	1.24	5.51	0.0105	2.41
1.47	0.0050	1.14	5.87	0.0115	2.65
2.20	0.0051	1.15	6.24	0.0123	2.82
2.94	0.0057	1.31	6.61	0.0125	2.86

SOLUBILITY OF PICRIC ACID IN ETHER.
(Bougault, 1903.)

Solvent.	t°.	Gms. $C_6H_3N_3O_7$ per Liter.	
Ether of Sp. Gr. 0.721	13	10.8	(B.)
Ether of Sp. Gr. 0.725 (0.8 pt. H_2O per 100)	13	36.8	"
Ether of Sp. Gr. 0.726 (1 pt. H_2O per 100)	13	40	"
Ether saturated with H_2O	15	51.2	
H_2O saturated with Ether	15	13.8	

100 parts of ether dissolve about 2.27 gms. picric acid at 15°. (S 1905.)
" chloroform " " 2 " " " "
" petroleum ether " " 0.04 " " " "
100 gms. sat. solution in pure ether contain 5 gms. picric acid at 20°. (Sisley, 1902.)
100 cc. sat. solution in pure ether contain 3.7 gms. picric acid at 20°. "
100 gms. sat. solution in pure toluene contain 12 gms. picric acid at 20°. "
100 cc. sat. solution in pure toluene contain 10.28 gms. picric acid at 20°. "
100 cc. sat. solution in pure amyl alcohol contain 1.755 gms. picric acid at 20°. "

DISTRIBUTION OF PICRIC ACID AT 25° BETWEEN:

Water and Amyl Alcohol.
(Herz and Fischer — Ber. 37, 4747, '04.)

Millimols $C_6H_3N_3O_7$ per 10 cc. Aq. Layer.	Alcohol Layer.	Gms. $C_6H_3N_3O_7$ per 100 cc. Aq. Layer.	Alcohol Layer.
0.0553	0.0930	0.127	0.213
0.0920	0.1850	0.211	0.424
0.1613	0.4127	0.369	0.946
0.1869	0.5182	0.428	1.188
0.3161	1.079	0.724	2.473
0.4471	1.638	1.024	3.753
0.5624	2.189	1.288	5.017
0.6423	2.549	1.472	5.839

Water and Toluene.
(H. and F. — Ber. 38, 1142, '05.)

Millimols $C_6H_3N_3O_7$ per 10 cc. Aq. Layer.	Toluene Layer.	Gms. $C_6H_3N_3O_7$ per 100 cc. Aq. Layer.	Toluene Layer.
0.075	0.126	0.172	0.289
0.109	0.230	0.250	0.527
0.163	0.482	0.374	1.104
0.244	1.026	0.559	2.351
0.389	2.347	0.891	5.380
0.496	3.747	1.137	8.586
0.583	5.135	1.336	11.770

Additional data for the distribution of picric acid between water and amyl alcohol and water and toluene at 20° are given by Sisley (1902). Very irregular results were obtained. The fact that the colors of the two layers are different, was taken to indicate that the picric acid dissolves in a different molecular form in the two layers.

DISTRIBUTION OF PICRIC ACID AT 25° BETWEEN:

Water and Bromoform. (Herz and Lewy — Z. Electrochem. 11, 820, '05.)

Millimols $C_6H_3N_3O_7$ per 10 cc. Aq. Layer.	Millimols per 10 cc. Bromoform Layer.	Gms. $C_6H_3N_3O_7$ per 100 cc. Aq. Layer.	Gms. per 100 cc. Bromoform Layer.
0.321	0.365	0.736	0.836
0.401	0.515	0.919	1.180
0.475	0.655	1.088	1.501
0.575	0.871	1.317	1.995
0.674	1.14	1.545	2.612

Water and Chloroform. (H. and L.)

Millimols $C_6H_3N_3O_7$ per 10 cc. Aq. Layer.	Millimols per 10 cc. Chloroform Layer.	Gms $C_6H_3N_3O_7$ per 100 cc Aq. Layer.	Gms per 100 cc Chloroform Layer.
0 207	0 254	0.474	0.582
0.329	0 547	0.754	1.253
0.488	1.09	1.118	2.498
0.561	1 41	1.285	3.230
0.588	1.53	1.348	3.505

DISTRIBUTION OF PICRIC ACID BETWEEN:

Water and Benzene. (Kuriloff, 1898.)

Mols. Picric Acid per Liter: Aq. Layer.	Mols. Picric Acid per Liter: C_6H_6 Layer
0.0261	0.0940
0.0208	0.0779
0.0188	0.0618
0.0132	0.0359
0.0097	0.0198

Water and Ether at 20°. (Sisley, 1902.)

Gms. Picric Acid per Liter: Aq Layer.	Gms. Picric Acid per Liter: Ether Layer.	Dist Coef.
6.78	17.85	2.63
3.74	6.70	1.79
2.85	3.72	1.34
0.85	0.11	0.13
0.10	0.001	0.01

Data for the distribution of picric acid between water and mixtures of chloroform and toluene at 25°, are given by Herz and Kurzer (1910).

FREEZING-POINT DATA (Solubilities, see footnote, p. 1) ARE GIVEN FOR THE FOLLOWING MIXTURES:

Picric Acid + Dimethylpyrone. (Kendall, 1914)
" + Resorcinol. (Philip and Smith, 1905)
" + Thymol. (Kendall, 1916)
" + α Trinitrotoluene. (Giua, 1916)

Methyl**PICRIC ACID** $C_6H(CH_3)(OH)(NO_2)_3$, 1.3.2.4.6.

SOLUBILITY IN AQUEOUS SOLUTIONS AT 25°. (Kendall, 1911.)

Aq. Solvent.	Normality of Dissolved Methyl Picric Acid	Aq Solvent.	Normality of Dissolved Methyl Picric Acid.
Water	0 0100	0 01975 *n o* Nitrobenzoic Acid	0 0080
" +Ligroin	0 01019	0 00981 *n* Salicylic Acid	0 01063
" +Toluene	0 01059	0 01393 *n* " "	0 01072
0.00895 *n* HCl	0 00641	H_2O+Excess of Salicylic Acid	0.02613*
0.01593 *n* HCl	0 00487		
0.01013 *n* Picric Acid	0 00702		

* = normality of salicylic acid + methylpicric acid.

PICROTOXIN $C_{30}H_{34}O_{13}$.

100 gms. H_2O dissolve 0.41+gm. picrotoxin at 20–25°. (Dehn, 1917.)
" pyridine dissolve 102 gms. " " "
" aq. 50% pyridine " 81 " " " "

PIMELIC ACID $(CH_2)_5(COOH)_2$.

DISTRIBUTION BETWEEN WATER AND ETHER AT 25°. (Chandler, 1908.)

Mols. $(CH_2)_5(COOH)_2$ per Liter. Aq. Layer, *a*.	Mols. per Liter. Ether Layer, *b*.	Dist Coef. $\frac{a}{b}$	Dist. Coef. Corrected for Ionization.
0.00998	0.01407	0.7095	0.670
0.00702	0.00979	0.7170	0.670
0.00480	0.00667	0.7195	0.663
0.00284	0.00380	0.7480	0.663
0.00179	0.00253	0.7075	0.653

PILOCARPINE $C_{11}H_{16}N_2O_2$.

100 cc. oil of sesame dissolve 0.3142 gm. $C_{11}H_{16}N_2O_2$ at 20°. (Zalai, 1910.)

PILOCARPINE HYDROCHLORIDE $C_{11}H_{16}N_2O_2.HCl$, Pilocarpine Nitrate $C_{11}H_{16}N_2O_2.HNO_3$, and Piperine $C_{17}H_{19}NO_3$ in Several Solvents.

(U. S. P., VIII.)

Solvent.	t°.	Gms. per 100 Gms. Solvent.		
		$C_{11}H_{16}N_2O_2.HCl$.	$C_{11}H_{16}N_2O_2.HNO_3$.	$C_{17}H_{19}NO_3$.
Water	25	333	25	insoluble
Alcohol	25	4.35	1.66	6.66
Alcohol	60	9.09	6.2	22.7
Chloroform	25	0.18	...	58.8
Ether	25	...	...	2.8

PINACOLIN $CH_3.CO.C(CH_3)_3$.

SOLUBILITY IN WATER AND IN AQ. ACETONE AT 15°. (Delange, 1908.)

Per cent Acetone in Solvent	cc. Pinacolin Dissolved per 100 cc. Solvent.
0 (= pure H_2O)	2.44
20	3.47
33	6.06
50	9.09
60	14.27

PINENE HYDROCHLORIDE $C_{10}H_{16}.HCl$.

100 gms. 95% formic acid dissolve 1.2 gms. $C_{10}H_{16}.HCl$ at 16.8°. (Aschan, 1913.)

PIPECOLINE $C_5H_9(CH_3)NH$ *d* and *l*.

F.-pt. data for mixtures of *d* and *l* pipecoline are given by Ladenburg and Sobecki (1910).

PIPERIDINE $CH_2<(CH_2.CH_2)_2>NH$.

DISTRIBUTION BETWEEN WATER AND BENZENE AT ORD. TEMP. (Georgievics, 1915.)

Gms. Piperidine per:		Gms. Piperidine per:	
25 cc. H_2O Layer.	75 cc. C_6H_6 Layer.	25 cc H_2O Layer.	75 cc. C_6H_6 Layer.
0.1573	0.4127	0.891	2.339
0.256	0.674	1.299	3.589
0.409	1.088	1.712	4.789
0.674	1.746		

PIPERIDINE HYDROCHLORIDE $CH_2<(CH_2.CH_2)_2>NH.HCl$.

SOLUBILITY IN SEVERAL SOLVENTS. (Freundlich and Richards, 1912.)

Solvent.	t°.	Mols. Piperidine HCl per Liter.
Water	0	4.87
"	25	5.19
Tetrachlor Ethane (sat. with H_2O)	0	0.13
" " "	25	0.29
Nitrobenzene "	25	0.00543
Benzene "	25	0.00102

Methyl**PIPERIDINES** 2-, 3-, 4-, *n* Methyl, etc.

Data for the reciprocal solubility of 2-methylpiperidine and water, 3-methylpiperidine and water, 4-methylpiperidine and water, nitrosopiperidine and water and for *n*-methylpiperidine and water, determined by the synthetic (sealed tube) method of Alexejeff, are given by Flaschner and MacEwan (1908) and by Flaschner (1909) and (1908). Similar data for *n*-ethylpiperidine and water and for *n*-propylpiperidine and water are given by Flaschner (1908).

$\alpha\alpha'$ Diphenyl PIPERIDINES $C_{17}H_{19}N$.

SOLUBILITIES OF THE ACID SALTS OF $\alpha\alpha'$ DIPHENYL PIPERIDINE AND OF ISO $\alpha\alpha'$ DIPHENYL PIPERIDINE IN WATER AT 25°.

(Scholtz, 1901.)

Piperidine Base.	Gms. per 100 Gms. Sat. Solution: HCl Salt.	HBr Salt.	HI Salt.	H_2SO_4 Salt.
α, α' Diphenyl Piperidine, m. pt. 71°	0.85	0.90	0.12	6.31
Iso α, α' Diphenyl Piperidine, liquid	3.02	1	0.72	easily soluble

PIPERINE $C_{17}H_{19}NO_3$. (See also under Pilocarpine, preceding page.)

SOLUBILITY IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. $C_{17}H_{19}NO_3$ per 100 Gms. Solvent.	Authority.
Water	20–25	0.01	(Dehn, 1917)
Ethyl Alcohol	9.5	2.9	(Timofeiew, 1894.)
Methyl "	9.5	4.4	"
Propyl "	9.5	2.94	"
Trichlor Ethylene	15	9.83	(Wester and Bruins, 1914.)
Pyridine	20–25	22.46	(Dehn, 1917)
Aq. 50% Pyridine	20–25	11.39	"

PLATINUM ALLOYS.

SOLUBILITY OF PLATINUM ALLOYS IN NITRIC ACID.

(Winkler — Z. anal. Ch. 13, 369, '74.)

Alloy.	Approx. per cent Pt in Alloy.	Grams Alloy Dissolved per 100 Grams HNO_3 Solution of 1.398 Sp. Gr.	1.298 Sp. Gr.	1.190 Sp Gr.	1.298 Sp. Gr.
Pt and Silver	10	57	44	69	37
"	5	69	57	51	35
"	2.5	62	61	69	..
"	1	75	70	76	..
Pt and Copper	10	46	27	11	51
"	5	36	34	14	41
"	2.5	51	40	30	..
"	1	52	41	37	..
Pt and Lead	10	7	9	8	..
"	5	8	9	10	..
"	2.5	22	17	11	..
"	1+	21	18	23	..
Pt and Bismuth	10	14	19	4	3
"	5	21	20	6	18
"	2.5	25	42	8	..
"	1	49	64	10	..
Pt and Zinc	10	10	11	19	5
"	5	16	12	6	11
"	2.5	16	24	19	..
"	1	20	32	37	..

PLATINUM BROMIDE $PtBr_4$.

100 grams sat. aqueous solution contain 0.41 gram $PtBr_4$ at 20°.
(Halberstadt — Ber. 17, 2962, '84.)

PLATINIC POTASSIUM BROMIDE K_2PtBr_6.

100 grams sat. aqueous solution contain 2.02 grams K_2PtBr_6 at 20°.
(Halberstadt.)

PLATINIC DOUBLE CHLORIDES of Ammonium, Caesium, Potassium, Rubidium and Thallium. (Data for each separately.)

SOLUBILITY IN WATER.

(Crookes — Chem. News 9, 37, 205, '64; Bunsen — Pogg. Ann 113, 337, '61.)

t°.	Grams per 100 Grams Water. $(NH_4)_2PtCl_6$.	Cs_2PtCl_6.	K_2PtCl_6.	Rb_2PtCl_6.	Tl_2PtCl_6.
0	...	0.024	0.74	0.184	...
10	0.666 (15°)	0.050	0.90	0.154	0.0064 (15°)
20	...	0.079	1.12	0.141	...
25	...	0.095	1.26	0.143	...
30	...	0.110	1.41	0.145	...
40	...	0.142	1.76	0.166	...
50	...	0.177	2.17	0.203	...
60	...	0.213	2.64	0.253	...
70	...	0.251	3.19	0.329	...
80	...	0.291	3.79	0.417	...
90	...	0.332	4.45	0.521	...
100	1.25	0.377	5.18	0.634	0.050

SOLUBILITY OF POTASSIUM CHLOROPLATINATE IN WATER AND IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AND OF SODIUM CHLORIDE.

(Archibald, Wilcox and Buckley, 1908)

Solubility in Water. t°.	Gms K_2PtCl_6 per 100 Gms. H_2O	In Aq. KCl at 20°. Gm Mols. KCl per Liter.	Gms K_2PtCl_6 per 100 Gms. Solvent	In Aq. NaCl at 16°. Gm Mols. NaCl per Liter.	Gms K_2PtCl_6 per 100 Gms. Solvent.
0	0.4784	0.20	0.0236	0	0.672
10	0.5992	0.25	0.0207	0.05	0.700
20	0.7742	0.50	0.0109	0.10	0.729
30	1	1	0.0046	0.25	0.758
40	1.355	2	0.0045	0.50	0.775
60	2.444	3	0.0043	0.75	0.791
80	3.711	4	0.0042	1	0.805
100	5.030	sat.	0.0034	2	0.834

SOLUBILITY OF POTASSIUM CHLOROPLATINATE IN AQUEOUS SOLUTIONS OF METHYL ALCOHOL AND OF ETHYL ALCOHOL AT 20°.

(Archibald, Wilcox and Buckley, 1908)

Wt. Per cent Alcohol in Solvent.	Gms K_2PtCl_6 per 100 Gms: Aq CH_3OH.	Aq C_2H_5OH.	Wt. Per cent Alcohol in Solvent.	Gms K_2PtCl_6 per 100 Gms.: Aq CH_3OH.	Aq C_2H_5OH.
0	0.7742	0.7742	50	0.0625	0.0491
5	0.535	0.491	60	0.0325	0.0265
10	0.412	0.372	70	0.0182	0.0128
20	0.264	0.218	80	0.0124	0.0085
30	0.1831	0.134	90	0.0038	0.0025
40	0.1165	0.076	100	0.0027	0.0009

100 gms. aq. 8.2% isobutyl alcohol dissolve 0.625 gm. K_2PtCl_6 at 20°.
100 gms. aq. sat. isobutyl alcohol dissolve 0.318 gm. K_2PtCl_6 at 20°.
(Archibald, Wilcox and Buckley, 1908.)

One liter of 55% alcohol dissolves 0.150 gm. $(NH_4)_2PtCl_6$ at 15–20°. (Fresenius, 1846.)
" 76% " " 0.067 " " " "
" 95% " " 0.0037 " " " "

DISTRIBUTION OF PLATINUM CHLORIDE BETWEEN WATER AND ETHER AT ORD. TEMP. (Mylius, 1911)

When 1 gm. of platinum as chloride is dissolved in 100 cc. of aq. 10% HCl and shaken with 100 cc. of ether, 0.01 per cent of the platinum enters the etheral layer. If water is used instead of 10% HCl, approximately the same per cent of Pt enters the ether layer.

100 cc. anhydrous hydrazine dissolve 1 gm. platinic chloride, with formation of a black precipitate at room temp. (Welsh and Broderson, 1915)

ChloroPLATINATES of Hydrocarbon Sulfines.

SOLUBILITY OF EACH IN WATER AT 16°. (Strömholm, 1900.)

Chloroplatinate. Name.	Formula	Gms. Salt per 100 Gms. Sat Solution.
Trimethyl Sulfine Chloroplatinate	$[(CH_3)_3S]_2PtCl_6$	0.47
Dimethyl Ethyl Sulfine Chloroplatinate	$[(CH_3)_2(C_2H_5)S]_2PtCl_6$	3.43
Methyl Diethyl Sulfine Chloroplatinate	$[CH_3(C_2H_5)_2S]_2PtCl_6$	2.42
Triethyl Sulfine Chloroplatinate	$[(C_2H_5)_3S]_2PtCl_6$	1.98

Similar results for more complex sulfines are also given.

PLATINO AMINES.

SOLUBILITY IN WATER. (Cleve, 1866?)

Amine	Formula.	Gms per 100 Gms. H_2O.
Platino Semi Diamine Chloride	$Pt<{(NH_3)_2.Cl \atop Cl}$	0.26 at 0°, 3 4 at 100°
Chloro Platino Amine Chloride	$Cl_2Pt<{NH_3Cl \atop NH_3Cl}$	0.14 at 0°, 3 at 100°
Chloro Platino Semi Diamine Chloride	$Cl_3Pt(NH_3)_2Cl$	0.33 at 0°, 1.54 at 100°

PLATINOUS NITRITE AMMONIUM COMPOUNDS.

SOLUBILITY IN WATER. (Tschugaev and Kiltinovic, 1916)

When ammonia is added to a cold solution of potassium platinonitrite a copious precipitate of the composition $Pt2NH_3(NO_2)_2$, is obtained. By comparison of the solubility of this precipitate with that of each of three hitherto described ammonioplatinum compounds, it was found that the precipitate obtained as described, corresponds to the *cis* form of dinitro diammonio platinum, ${NH_3 \atop NH_3}>Pt<{NO_2 \atop NO_2}$

The results for the solubility of *cis* and *trans* dinitro diammonio platinum and of tetra ammonia platinous platinonitrite in water, are as follows:

t°.	Gms Each Compound per 100 Gms. H_2O. *cis* $Pt2NH_3(NO_2)_2$.	*trans* $Pt2NH_3(NO_2)_2$.	$[Pt_4NH_3][Pt(NO_2)_4]$.
25	0.083	0.063	0.011
63	0.66	0.49	...
74.4	...	0.81	...
95	2.32	1.85	...

Determinations of the solubility of several mixtures of the *cis* and *trans* compounds in water are also given.

PONCEAU (Free Acid) $C_{10}H_7N{:}N.C_{10}H_4(OH)(SO_3H)_2.9H_2O$.

SOLUBILITY IN SEVERAL SOLVENTS AT 23.° (Sisley, 1902.)

Solvent.	Gms. Ponceau per Liter.
Water	209.6
" $+5$ Gms. H_2SO_4 per Liter	180
" Sat. with Amyl Alcohol	195
Amyl Alcohol	73.4
Ether, pure	none

Data are also given for the distribution of ponceau between water and amyl alcohol at 18°.

POTASSIUM K_2.

SOLUBILITY OF POTASSIUM IN LIQUID AMMONIA. (Ruff and Geisel, 1906.)

t°.	Mols. NH_3 to Dissolve 1 Gm. Atom K.
−100	4.82
−50	4.79
0	4.74

SOLUBILITY OF POTASSIUM IN MELTED KOH. (von Hevesy, 1909.)

Difficulty was experienced due to the failure of the excess of K to separate completely from the saturated solution. Time of heating, 50 hours.

t°.	Gms. K per 100 Gms. KOH.
480	7.8–8.9
600	3 –4
650	2 –2.7
700	0.5–1.3

POTASAMMONIUM $K_2(NH_3)_2$.

100 gms. liquid ammonia dissolve 99.5 gms. $K_2(NH_3)_2$ at 0° and 97 gms. at +8.44°. (Joannis, 1906.)

POTASSIUM ACETATE $CH_3COOK.1\frac{1}{2}H_2O$.

SOLUBILITY IN WATER. (Abe, 1911)

t°.	Gms. CH_3COOK per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. CH_3COOK per 100 Gms. H_2O	Solid Phase.
0.1	216.7	$2CH_3COOK.3H_2O$	41	327.7	$2CH_3COOK.3H_2O$
5	223.9	"	41.3 tr. pt.	...	" $+2CH_3COOK.H_2O$
10	233.9	"	42	329	$2CH_3COOK.H_2O$
15	243.1	"	45	332.2	"
20	255.6	"	50	337.3	"
25	269.4	"	60	350	"
30	283.8	"	70	364.8	"
35	301.8	"	80	380.1	"
38	314.2	"	90	396.3	"
40	323.3	"	96	406.5	"

SOLUBILITY OF POTASSIUM ACETATE IN AQ. ALCOHOL SOLUTIONS AT 25°. (Seidell, '10.)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. CH_3COOK per 100 Gms Solvent.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. CH_3COOK per 100 Gms. Solvent.
0	1.417	219.6	70	1.156	118.3
20	1.363	219.6	80	1.085	87.6
40	1.302	192.4	90	0.990	52.9
50	1.260	171.8	95	0.922	34.2
60	1.210	147.5	100	0.850	16.3

F.-pt. data for potassium acetate + acetic acid (Vasilev, 1909); potassium acetate + sodium acetate (Baskov, 1915). (Baskov, 1915.)

POTASSIUM SulfoANTIMONATE $K_3SbS_4.5H_2O$.

SOLUBILITY IN WATER. (Donk, 1908.)

t°.	Gms. K_3SbS_4 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. K_3SbS_4 per 100 Gms. Sat. Sol.	Solid Phase.
− 1.3	9.5	Ice	−34	62	Ice$+K_3SbS_4.6H_2O$
− 2.6	17.1	"	−10	65.5	$K_3SbS_4.6H_2O$
− 4	24.2	"	− 4.5	69.1	"
− 7.2	35.4	"	0	75.4	$K_3SbS_4.5H_2O$
−10.6	42.9	"	+10	76.2	"
−13.5	48.8	"	30	75.1	"
−18.5	52.6	"	50	77.7	$K_3SbS_4.3H_2O$
−28.8	59.6	"	80	79.2	"

SOLUBILITY OF POTASSIUM SULFOANTIMONATE IN AQ. SOLUTIONS OF POTASSIUM HYDROXIDE AT 30° AND VICE VERSA.

(Donk, 1908)

Gms. per 100 Gms. Sat. Sol. K_3SbS_4.	Gms. per 100 Gms. Sat. Sol. KOH.	Solid Phase.	Gms per 100 Gms. Sat Sol. K_3SbS_4.	Gms per 100 Gms. Sat Sol. KOH	Solid Phase.
75	0	$K_3SbS_4.5H_2O$	19.8	40.5	K_3SbS_4
68.4	3.4	$K_3SbS_4.3H_2O$	11.5	49.9	" $+KOH.2H_2O$
56.8	11	"	9.4	49.9	$KOH.2H_2O$
50.9	16.1	K_3SbS_4	0	56.3	"
37.7	25.5	"			

SOLUBILITY OF POTASSIUM SULFOANTIMONATE IN AQ. ETHYL ALCOHOL.

(Donk, 1908.)

Results at 10°. Gms. per 100 Gms. Sat Sol. K_3SbS_4.	C_2H_5OH.	Solid Phase.	Results at 30°. Gms. per 100 Gms. Sat. Sol. K_3SbS_4.	C_2H_5OH.	Solid Phase.
0	94	$K_3SbS_4.5H_2O$	0	97	$K_3SbS_4.3H_2O$
0	90.5	"			
Two Liquid Layers Formed Here.			Two Liquid Layers Formed Here.		
69.2	0.8	"	75.1	0	"
76.1	0	"			

Composition of the Liquid Layers (at 10°). Gms per 100 Gms.

Alcoholic Layer. K_3SbS_4.	C_2H_5OH.	Aqueous Layer K_3SbS_4	C_2H_5OH.
0	85	67.4	1.1
2.2	54.7	49	3.4
4.2	46.9	45.6	3.8
27.4	16	...	...
...	...	12.7	31.1

Composition of the Liquid Layers (at 30°). Gms per 100 Gms.

Alcoholic Layer. K_3SbS_4.	C_2H_5OH.	Aqueous Layer. K_3SbS_4.	C_2H_5OH.
0	93.1	70.5	±0.5
0	85.6	65.2	1.2
2.2	56.8	47.8	5.7
8.5	41.1	37.1	9.2

SOLUBILITY OF POTASSIUM SULFOANTIMONATE IN AQ. METHYL ALCOHOL AT 15°.

(Donk, 1908)

Gms. per 100 Gms Sat Sol K_3SbS_4.	CH_3OH.	Solid Phase.
0.5	99.5	K_3SbS_4
0.45	99.5	"
1.5	93.9	"
1.8	92	"
Two Liquid Layers Formed Here.		
62.7	7.5	$K_3SbS_4.9H_2O$
68.4	3.5	"
75.5	0	"
Two Liquid Layers Formed Here.		
0.5	98.1	"

Composition of the Liquid Layers. Gms per 100 Gms

Alcoholic Layer K_3SbS_4.	CH_3OH.	Aqueous Layer K_3SbS_4.	CH_3OH.
5	82.5	62.5	8
4.9	76.3	...	...
7	66.9	...	...
13.6	54	...	...
19.1	45.5	...	...
...	...	31.1	31.3
...	...	41.1	22.2
...	...	47.2	18.2
...	...	57.2	11.1

POTASSIUM (Dihydrogen) **ARSENATE** KH_2AsO_4.

100 gms. sat. aq. solution contain 15.9 gms. KH_2AsO_4, or 100 gms. H_2O dissolve 18.86 gms. at 6°. Sp. Gr. of solution = 1.1134. (Field, 1859.)

100 cc. sat. aq. solution contain 28.24 gms. KH_2AsO_4 at about 7°. (Muthmann and Kuntze, 1894.)

100 gms. glycerol (d_{15} = 1.256) dissolve 50.1 gms. potassium arsenate at 15–16°. (Ossendowski, 1907.)

POTASSIUM BENZOATE $KC_7H_5O_2.3H_2O$.

SOLUBILITY IN WATER.

(Pajetta, 1906, 1907.)

t°.	17.5°	25°	33.3°	50°
Gms. $KC_7H_5O_2$ per 100 Gms. Solution	41.1	42.4	44	46.6

POTASSIUM BORATES.

SOLUBILITY OF POTASSIUM BORATES IN WATER AT 30°.

(Dukelski — Z. anorg. Chem. 50, 42, '06, complete references given.)

Gms. per 100 Gms. Solution.		Gms. per 100 Gms. Residue.		Solid Phase.
K_2O.	B_2O_3.	K_2O.	B_2O_3.	
47.50	...	...	...	$KOH.2H_2O$
46.36	0 91	46.13	9.02	$K_2O.B_2O_3.2\frac{1}{2}H_2O$
40.51	1.25	41 62	9.71	"
36.82	1 80	39.90	13.19	"
32.74	3.51	37.22	14.58	"
29.63	6.98	35.05	17.92	"
24.84	17.63	30.02	21.70	"
23.30	18.19	26.84	31.49	$K_2O.2B_2O_3.4H_2O$
16.21	13.10	25.12	33.18	"
11.78	9 82	20.57	26.43	"
9.18	8.00	22.38	31 30	"
6.22	9 13	20 87	31 06	"
7.73	13.37	22.21	36 24	$K_2O.2B_2O_3.4H_2O + K_2O.5B_2O_3.8H_2O$
7.81	13.28	17.50	34.18	"
7.71	13 21	11.49	34 81	$K_2O.5B_2O_3.8H_2O$
7.63	13.28	12 51	40 52	"
3 42	7.59	10.77	37 35	"
1.80	4.15	5.88	20 00	"
0.51	3.19	10.81	40.89	"
0.33	4.58	7.72	34.21	$K_2O.5B_2O_3.8H_2O + B(OH)_3$
0.31	4.46	3.91	30.68	"
...	3.54	...	...	"

POTASSIUM Meta**BORATE** KBO_2.

Fusion-point data for potassium metaborate + sodium metaborate and for potassium metaborate + potassium metaphosphate are given by van Klooster (1910–11).

POTASSIUM Per**BORATES,** $2KBO_3.H_2O$, $2KBO_3.H_2O_2$.

SOLUBILITY OF EACH IN WATER.

(v. Girsewald and Wolokitin, 1909)

Borate	% Active O in Borate.	t°.	Gms. Salt per 100 Gms. Water.
$2KBO_3.H_2O$	14.93	0	1.25
"	14.93	15	2.50
$2KBO_3.H_2O_2$	20.84	15	0.70

POTASSIUM (Fluo) **BORIDE** KBF_4.

100 gms. H_2O dissolve 0.44 gm. KBF_4 at 20°, and 6.27 gms. at 100°. (Stolba, 1889.)

POTASSIUM BROMATE $KBrO_3$.

SOLUBILITY IN WATER.

(Kremers — Pogg. Ann. 97, 5, '56; Rammelsberg — *Ibid.* 55, 79, '42; Pohl — Sitzber. Akad. Wiss Wien. 6, 595, '51)

t°.	Gms. $KBrO_3$ per 100 Gms. Water.	Gms. $KBrO_3$ per 100 Gms. Solution.	t°.	Gms. $KBrO_3$ per 100 Gms. Water.	Gms. $KBrO_3$ per 100 Gms. Solution.
0	3 1	3 0	40	13.2	11.7
10	4.8	4 6	50	17.5	14.9
20	6.9	6.5	60	22.7	18.5
25	8.0	7.4	80	34 0	25.4
30	9.5	8.7	100	50.0	33.3

Sp. Gr. of solution saturated at 19.5° = 1.05.

SOLUBILITY OF POTASSIUM BROMATE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AND OF SODIUM CHLORIDE.

(Geffcken — Z. physik. Chem. 49, 296, '04)

In Sodium Nitrate.

Grams per Liter. $NaNO_3$.	Grams per Liter. $KBrO_3$.	Mols $KBrO_3$ per Liter.
0.0	78 79	0 4715
42 54	96 01	0 5745
85.09	108 6	0 6497
170 18	128 3	0.7680
255.27	150.9	0.9026
340.36	172.3	1 031

In Sodium Chloride.

Grams per Liter. NaCl.	Grams per Liter. $KBrO_3$.	Mols. $KBrO_3$ per Liter.
0 0	78 79	0.4715
29 25	82.24	0 5220
58 50	93.87	0.5616
117 0	100.9	0 6042
175.5	104 3	0.6244
234.0	106 9	0.6400

SOLUBILITY OF POTASSIUM BROMATE IN AQUEOUS SOLUTIONS OF VARIOUS COMPOUNDS AT 25°.

(Rothmund, 1910.)

Solvent, 0 5 Normal Aq. Sol. of.	Mols $KBrO_3$ per Liter	Gms $KBrO_3$ per Liter.	Solvent, 0 5 Normal Aq Sol of.	Mols $KBrO_3$ per Liter	Gms. $KBrO_3$ per Liter.
Water alone	0 478	79.84	Dimethylpyrone	0.478	79.84
Methyl Alcohol	0 444	74.16	Ammonia	0.445	74.33
Ethyl Alcohol	0 421	70 33	Dimethylamine	0.384	64.13
Propyl Alcohol	0.409	68 31	Pyridine	0 415	69.31
Tertiary Amyl Alcohol	0.383	63 97	Piperidine	0.396	66.15
Acetone	0.425	70.99	Urethan	0 433	72.33
Ethyl Ether	0.395	65.98	Formamide	0.473	79.02
Formaldehyde	0 397	66.31	Acetamide	0.445	74.33
Glycol	0.448	74.84	Glycocol	0 501	83.68
Glycerol	0.451	75.34	Acetic Acid	0.456	76.17
Mannitol	0.451	75.34	Phenol	0.426	71 15
Grape Sugar	0.431	71.99	Methylal	0.405	67.66
Urea	0.477	79.68	Methyl Acetate	0.420	70.15

POTASSIUM BROMIDE KBr.

Solubility in Water.

(Average curve from results of Meusser — Z. anorg. Chem. 44, 79, '05; Etard — Compt. rend. 98, 1432, '84; Ann. chim. phys. [7] 2, 526, '94; de Coppet — Ibid. [5] 30, 416, '83; Tilden and Shenstone — Phil. Trans. 175, 23, '84.)

t°.	Grams KBr per 100 Grams Solution.	Grams KBr per 100 Grams Water.	t°.	Grams KBr per 100 Grams Solution.	Grams KBr per 100 Grams Water.
− 6.5	20.0	25.0	30	41.4	70.0
− 8.5	26.5	35.7	40	43.0	75.5
−10.5	29.5	41.8	50	44.5	80.2
−11.5	31.2	45.3	60	46.1	85.5
−10	31.8	46.7	70	47.4	90.0
− 5	33.3	50.0	80	48.7	95.0
0	34.9	53.5	90	49.8	99.2
5	36.1	56.5	100	51.0	104.0
10	37.3	59.5	110	52.3	109.5
15	38.5	62.5	140	54.7	120.9
20	39.5	65.2	181	59.3	145.6
25	40.4	67.7			

Solubility of Mixtures of Potassium Bromide and Ammonium Bromide in Water at 25°.

(Fock — Z. Kryst. Min. 28, 357, '97.)

Grams per Liter Solution. NH_4Br.	Grams per Liter Solution. KBr.	Mol. per cent in Solution. NH_4Br.	Mol. per cent in Solution. KBr.	Sp. Gr. of Solutions.	Mol. per cent in Solid Phase. NH_4Br.	Mol. per cent in Solid Phase. KBr.
0.00	558.1	0.0	100	1.3756	0.00	100
6.4	554.2	1.38	98.62	1.3745	0.26	99.74
24.64	536.5	5.29	94.71	1.3733	1.27	98.73
51.34	516.8	10.77	89.23	1.3721	3.02	96.98
152.9	441.2	29.63	70.37	1.3711	8.42	91.58
262.2	347.3	47.84	52.16	1.3715	17.20	82.80
347.6	262.3	61.69	38.31	1.3753	27.98	72.02
381.4	260.3	64.03	35.97	1.3753	32.53	67.47
417.8	232.2	68.61	31.39	1.3766	39.45	60.55
432.5	222.3	70.27	29.73	1.3777	variable	variable
480.8	179.9	76.47	23.53	1.3766	98.53	1.47
577.3	0.0	100.0	0.0	1.3763	100.0	0.00

Solubility of Potassium Bromide at 25° in:

Aq. Solutions of KCl and Vice Versa.
(Amadori and Pampanini, 1911.)

Gms. per 100 Gms H_2O. KBr.	Gms. per 100 Gms H_2O. KCl.
68.47	0
62.26	5.43
58.50	8.46
52.45	12.48
45.42	17.17
38.70	21.23
26.62	25.88
12.94	31.02
0	36.12

Aq. Solutions of KI and Vice Versa.
(Amadori and Pampanini, 1911.)

Gms per 100 Gms. H_2O. KBr.	Gms per 100 Gms. H_2O. KI.
53.21	35.92
42.32	66.63
34.14	95.36
30.08	119.52
29.62	119
22.15	127.10
21.88	127.31
18.54	130.61
0	149.26

(See also next page.)

SOLUBILITY OF POTASSIUM BROMIDE IN AQUEOUS SOLUTIONS OF POTASSIUM HYDROXIDE.

(Ditte — Compt. rend. 124, 30, '97.)

Grams per 1000 Grams H_2O. KOH.	Grams per 1000 Grams H_2O. KBr.	Grams per 1000 Grams H_2O. KOH.	Grams per 1000 Grams H_2O. KBr.
36.4	558.4	277.6	248.1
113.5	433.6	434.7	137.1
177.2	358.1	579.6	64.8
231.1	281.2	806.9	33.4

SOLUBILITY OF MIXTURES OF POTASSIUM BROMIDE AND CHLORIDE AND OF MIXTURES OF POTASSIUM BROMIDE AND IODIDE IN WATER.

(Etard — Ann. chim. phys. [7] 3, 275, '97.)

t°.	Mixtures of KBr and KCl. Grams per 100 Gms. Solution. KBr.	KCl.	Mixtures of KBr and KI. Grams per 100 Grams Solution. KBr.	KI.
−20	17.5	10.5	9.2	42.5
0	21.5	10.8	9.9	45.3
10	23.2	11.0	10.2	46.6
20	24.8	11.2	10.5	47.5
25	25.5	11.3	10.7	48.0
30	26.3	11.4	10.9	48.6
40	28.0	11.5	11.2	49.6
60	30.6	11.8	11.9	51.3
80	33.4	12.1	12.6	52.7
100	35.7	12.6	13.2	53.8
120	38.0	12.9	14.0	54.8
150	40.6	13.4	14.9	55.5

SOLUBILITY OF POTASSIUM BROMIDE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE, AND OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM BROMIDE, AT 25.2°.

(Touren — Compt. rend. 130, 1252, '00.)

KBr in Aq. KCl Solutions. Mols. per Liter. KCl.	KBr.	Grams per Liter. KCl.	KBr.	KCl in Aq. KBr Solutions. Mols per Liter. KBr.	KCl.	Grams per Liter. KBr.	KCl.
0.0	4.761	0.0	567.0	0.0	4.18	0.00	311.8
0.67	4.22	50.0	502.5	0.49	3.85	58.4	287.2
0.81	4.15	60.4	494.2	0.85	3.58	101.3	267.1
1.35	3.70	100.7	440.7	1.31	3.19	156.1	238.0
1.48	3.54	110.4	421.6	1.78	2.91	211.9	217.1
1.61	3.42	120.0	407.2	2.25	2.58	268.0	192.4
1.70	3.34	126.8	397.7	2.69	2.33	320.4	173.8
2.46	2.50	183.5	297.7				
3.775	0.525	281.6	625.3				

SOLUBILITY OF POTASSIUM BROMIDE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE, AND OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF POTASSIUM BROMIDE, AT 14.5° AND AT 25.2°.

(Touren — Compt. rend. 130, 908, '00.)

KBr in Aqueous KNO_3 Solutions.

Mols. per Liter. KNO_3.	Mols. per Liter. KBr.	Grams per Liter. KNO_3.	Grams per Liter. KBr.
Results at 14.2°.			
0.0	4.332	0.0	515.9
0.362	4.156	36.6	494.9
0.706	4.093	71.4	487.4
1.235	3.939	124.9	469.1
Results at 25.2°.			
0.0	4.761	0.0	566.2
0.131	4.72	13.3	561.0
0.527	4.61	53.3	549.1
0.721	4.54	72.9	540.8
1.09	4.475	110.3	533.0
1.170	4.44	118.4	528.8
1.504	4.375	152.2	521.1

KNO_3 in Aq. KBr Solutions.

Mols. per Liter. KBr.	Mols. per Liter. KNO_3.	Grams per Liter. KBr.	Grams per Liter. KNO_3.
Results at 14.20°.			
0.0	2.228	0.0	225.4
0.356	2.026	42.4	205.0
0.784	1.835	93.4	185.7
1 092	1.730	130.0	175.0
1.577	1.587	187.8	160.6
2.542	1.406	302.7	142.2
3.536	1.308	421.1	132.3
Results at 25.2°.			
0.0	3.217	0.0	325.5
0.38	3.026	45.3	306.2
0.93	2.689	110.8	272.0
1.37	2.492	163 1	252.2
1 208	2.216	143.8	224.3
2.87	1.958	341.8	198.1
3.55	1.807	422.8	182.8

SOLUBILITY OF POTASSIUM BROMIDE IN ALCOHOLS AT 25°.

(de Bruyn — Z. physik. Chem. 10, 783, '92; Rohland — Z. anorg. Chem. 18, 327, '98.)

Alcohol.	Grams KBr Dissolved by 100 Gms. Alcohol at: Room Temp. (R.).	25° (de B.).
Methyl Alcohol	1 92	1.51 Abs. Alcohol
Ethyl Alcohol	0.28 (Sp. Gr. 0.81)	0.13 "
Propyl Alcohol	0.055	...

SOLUBILITY OF POTASSIUM BROMIDE IN AQUEOUS ALCOHOL.

(Taylor — J. Physic. Ch. 1, 724, '96–'97.)

Wt. per cent Alcohol in Solution.	Results at 30°. Gms. KBr per 100 Gms. Sat. Solution.	Results at 30°. Gms. KBr per 100 Gms. Solvent.	Results at 40°. Gms. KBr per 100 Gms. Sat. Solution.	Results at 40°. Gms. KBr per 100 Gms. Solvent.
0	41.62	71.30	43.40	76.65
5	38.98	67.25	40.85	72.70
10	36.33	63.40	38.37	69.00
20	31.09	56.40	33.27	62.30
30	25.98	50 15	28.32	56.45
40	21.24	44.95	23.22	50.46
50	16.27	38.85	18.11	44.25
60	11.50	32.50	13.02	37.40
70	6.90	24.70	7.98	28.90
80	3.09	15.95	3.65	18.95
90	0.87	8.80	1.03	10.45

100 gm. acetone dissolve 0.023 gm. KBr at 25°.

(Krug and McElroy — J. anal. Chem. 6, 184, '92.)

Solubility of Potassium Bromide in Dilute Aqueous Ethyl Alcohol.

Results at 0°. (Armstrong and Eyre, 1910–11.)

Wt. % C_2H_5OH in Solvent.	Gms. KBr per 100 Gms. Sat. Sol.
0	34.92
1.14	34.35
2.25	32.96
4.41	31.99
8.44	29.43

Results at 25°. (Armstrong, Eyre, Hussey and Paddison, 1907.)

Wt. % C_2H_5OH in Solvent.	Gms. KBr per 100 Gms. Sat. Sol	d_{25} of Sat. Sol.
0	40.78	1.3824
1.14	39.98	1.3727
2.25	39.54	1.3634
4.41	38.41	1.3443
12.14	34.97	1.2815
18.73	30.91	1.2322

100 gms. methyl alcohol dissolve 2.17 gms. KBr at 25°. (Turner and Bissett, 1913.)
" ethyl " " 0.142 gm. " " "
" propyl " " 0.035 " " " "
" amyl " " 0.003 " " " "

Solubility of Potassium Bromide in Aqueous Solutions of Methyl Alcohol at 25°.

(Herz and Anders, 1907.)

Wt. % CH_3OH in Solvent.	Gms KBr per 100 cc Sat Sol	d_{25} of Sat Sol.	Wt. % CH_3OH in Solvent.	Gms KBr per 100 cc Sat Sol.	d_{25} of Sat Sol.
0	56.04	1.3797	64	10.35	0.9801
10.6	46.28	1.300	78.1	5.24	0.8906
30.8	29.98	1.159	98.9	2.74	0.8411
47.1	19.28	1.058	100	1.69	0.8047

The solubility of potassium bromide in methyl alcohol at the critical temperature is given by Centnerszner (1910), as 0.2 gm. KBr per 100 gms. sat solution.

100 gms. 95% formic acid dissolve 23.2 gms. KBr at 18.5°. (Aschan, 1913.)
100 cc. anhydrous hydrazine dissolve 60 gms. KBr at room temp. (Welsh and Broderson, 1915.)
100 gms. hydroxylamine dissolve about 44.7 gms. KBr at 17°–18°. (de Bruyn, 1892.)

Solubility of Potassium Bromide at 25° in:

(Herz and Knoch, 1905.)

Aqueous Acetone.

cc. Acetone per 100 cc Solvent.	Per 100 cc Sat Solution: Millimols KBr.	Gms KBr.	Gms H_2O	Sp Gr Solutions
0	481.3	57.3	80.6	1.3793
20	366.7	43.67	69.5	1.2688
30	310.5	36.98	62.97	1.2118
40	259	30.85	55.60	1.1558
50	202.9	24.16	47.60	1.0918
60	144.9	17.22	39.15	1.0275
70	95.3	11.35	29.78	0.9591
80	46.5	5.54	20.10	0.8942
90	10.1	1.20	10.15	0.8340

Aqueous Glycerol.

Wt. % Glycerol in Solvent	KBr per 100 cc Sol.: Millimols.	Gms.	Sp. Gr. Solutions.
0	481.3	57.32	1.3793
13.28	444.3	52.91	1.3704
25.98	404	48.11	1.3655
45.36	340.5	40.55	1.3594
54.23	310.4	36.98	1.3580
83.84	219.25	26.11	1.3603
100	172.65	20.56	1.3691

100 cc. sat. solution of potassium bromide in furfurol ($C_4H_3O.COH$) contain 0.139 gm. KBr at 25°. (Walden, 1906.)

Fusion-point Data for Mixtures of KBr and Other Salts.

KBr + KF (Kurnakow and Wrzesnewsky, 1912; Ruff and Plato, 1903.)
KBr + KCl (Wrzesnewsky, 1912; Amadori and Pampanini, 1911; Ruff and Plato 1903.)
KBr + KI " " " " "
KBr + AgBr (Sandonnini, 1912.)
KBr + NaCl (Ruff and Plato, 1903.)
KBr + KOH (Scarpa, 1915.)

POTASSIUM BUTYRATE C_3H_7COOK.

100 gms. water dissolve 296.8 gms. C_3H_7COOK, or 100 gms. sat. solution contain 74.8 gms. at 31.25°.

100 gms. of an aq. solution saturated with sugar and C_3H_7COOK contain 49.19 gms. sugar + 34.78 gms. C_3H_7COOK + 16.03 gms. H_2O at 31.25°.

(Köhler, 1897.)

POTASSIUM CAMPHORATES.

SOLUBILITY IN AQUEOUS SOLUTIONS OF *d* CAMPHORIC ACID AT 13.5–16° AND VICE VERSA.

(Jungfleisch and Landrieu, 1914.)

Gms. per 100 Gms. Sat. Sol. $C_8H_{14}(COOH)_2$.	Gms. per 100 Gms. Sat. Sol. $C_{10}H_{14}O_4K_2$.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. $C_8H_{14}(COOH)_2$.	Gms. per 100 Gms. Sat. Sol. $C_{10}H_{14}O_4K_2$.	Solid Phase.
0	66.65	$C_{10}H_{14}O_4K_2$	2.90	32.84	$C_{10}H_{15}O_4K.C_{10}H_{16}O_4$
0.90	69.69	$C_{10}H_{15}O_4K$	3.20	29.39	"
1	69	"	3.30	28.56	$C_{10}H_{15}O_4K.3C_{10}H_{16}O_4$
1.10	66.79	"	3.20	27.32	"
0.90	66.65	$C_{10}H_{15}O_4K.H_2O$	3.20	22.77	"
1.50	62.37	"	3.10	21.66	"
2.60	59.34	"	2.90	12.97	"
3.20	58.37	"	2.90	11.73	"
3.20	58.09	"	3.10	11.59	$dC_8H_{14}(COOH)_2$
3.20	52.71	$C_{10}H_{15}O_4K.C_{10}H_{16}O_4$	2.90	9.66	"
3.20	48.43	"	2.80	8.14	"
2.80	47.88	"	2.50	6.76	"
2.80	42.36	"	2.30	6.07	"
3	35.60	"	2	4.55	"
2.85	34.77	"	0.621	0	"

$C_{10}H_{14}O_4K_2$ = Dipotassium *d* camphorate. $C_{10}H_{15}O_4K.C_{10}H_{16}O_4$ = Monopotassium *d* dicamphorate.
$C_{10}H_{15}O_4K$ = Monopotassium *d* camphorate. $C_{10}H_{15}O_4K.3C_{10}H_{16}O_4$ = Monopotassium *d* tetracamphorate.

POTASSIUM CARBONATE $K_2CO_3.2H_2O$.

SOLUBILITY IN WATER.

(de Coppet, 1872, Meyerhoffer, 1905; Osaka, 1910–12, Kremann and Zitek, 1909; de Waal, 1910; Mulder, 1864.)

t°.	Gms. K_2CO_3 per 100 Gms. Sat. Solution.	Solid Phase.	t°.	Gms. K_2CO_3 per 100 Gms. Sat. Solution.	Solid Phase.
−10	21.3	Ice	40	53.9	$K_2CO_3.2H_2O$
−20	31	"	50	54.8	"
−30	36.9	"	60	55.9	"
−36.5 Eutec.	39.6	" $+K_2CO_3.xH_2O$	70	57.1	"
− 6.8 tr. pt.	50.9	$K_2CO_3.xH_2O+K_2CO_3.2H_2O$	80	58.3	"
0	51.3	$K_2CO_3.2H_2O$	90	59.6	"
+10	52	"	100	60.9	"
20	52.5	"	110	62.5	"
25	52.8	"	120	64.4	"
30	53.2	"	130	66.2	"

Single determinations, not in good agreement with the above, are given by Köhler (1897), by Engel (1888), and by Greenish and Smith (1901).

POTASSIUM BiCARBONATE $KHCO_3$.

SOLUBILITY IN H_2O. (Dibbets, 1874.)

t°.	0	10	20	30	40	60
Gms. $KHCO_3$ per 100 Gms. Sat. Sol.	18.3	21.7	24.9	28.1	31.2	37.5

100 gms. sat. aqueous solution contain 18.7 gms. $KHCO_3$ at 0° (d = 1.127) (Engel, 1888); 23.7 gms $KHCO_3$ at 15° (Greenish & Smith, 1901); 26.3 gms. at 20° (de Forcrand, 1909).

SOLUBILITY OF POTASSIUM BICARBONATE IN AQUEOUS SOLUTIONS OF POTASSIUM CARBONATE AT 0°. (Engel, 1888.)

Milligram Mols. per 1 cc. Solution.		Sp. Gr. of Solutions.	Grams per 100 cc. Solution	
$\frac{1}{2}K_2CO_3$.	$KHCO_3$		K_2CO_3.	$KHCO_3$.
0.0	21.15	1.133	0.0	21.2
17.14	15.28	1.182	11.8	15.3
24.10	12.65	1.20	16.7	12.6
34.50	10.25	1.241	23.8	10.3
49.20	7.55	1.298	34.0	7.6
62.14	5.86	1.350	43.0	5.9
74.60	4.90	1.398	51.6	4.9
87.50	3.75	1.448	60.5	3.8
117.75	0 0	1.542	81 4	0.0

SOLUBILITY OF POTASSIUM CARBONATE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AND OF POTASSIUM HYDROXIDE AT 30°. (de Waal, 1910)

Results for K_2CO_3 + KCl.

Gms per 100 Gms Sat Sol		Solid Phase.
K_2CO_3.	KCl.	
53.27	0	$K_2CO_3.1\frac{1}{2}H_2O$
52.22	1.03	" +KCl
51.66	1.07	KCl
1.64	26 22	"
0	28 01	"

Results for K_2CO_3 + KOH.

Gms per 100 Gms Sat. Sol.		Solid Phase.
K_2CO_3.	KOH.	
53.27	0	$K_2CO_3.1\frac{1}{2}H_2O$
2.50	53 77	"
2.05	55.14	" +$KOH.2H_2O$
0	55.75	$KOH.2H_2O$

100 gms. H_2O dissolve 10.76 gms. K_2CO_3 + 2.66 gms. KNO_3 at 10° when both salts are present in excess. (Kremann and Zitek, 1909)

100 gms. H_2O dissolve 10.53 gms. K_2CO_3 + 6.12 gms. Na_2CO_3 at 10° when both salts are present in excess (Kremann and Zitek, 1909). See also Potassium Sodium Carbonate, p. 512.

Data for aqueous solutions of K_2CO_3 + KNO_3 + Na_2CO_3 + $NaNO_3$, simultaneously saturated with two or more of the salts at 10° and at 25°, are also given by Kremann and Zitek (1909).

Data for the reciprocal salt pairs $K_2CO_3 + BaSO_4 \rightleftarrows K_2SO_4 + BaCO_3$ at 25°, 80° and 100° are given by Meyerhoffer (1905).

An aqueous solution, simultaneously saturated with $K_2CO_3.2H_2O$, K_2SO_4 and $BaCO_3$, contains 53.1 gms. K_2CO_3 + 0.023 gm. K_2SO_4 at 25°. (Meyerhoffer, 1905.)

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE, ETHYL ALCOHOL AND WATER AT 23°–26°. (Frankforter and Frary, 1913)

NOTE.—The binodal curve for the system (see note, p. 287) was very carefully determined and tie lines were located by estimations of K_2CO_3 in specially prepared conjugated liquids. The original results have been plotted and the following data for the conjugated layers read from the curve:

Alcohol Rich Layer (Upper) Gms per 100 Gms Solution			Water Rich Layer (Lower.) Gms per 100 Gms. Solution.		
K_2CO_3.	C_2H_5OH.	H_2O	K_2CO_3	C_2H_5	H_2O
0.095	90.65	9.255†	53.6	0.28	46.12†
0.241	72.7	27.059	39.11	1	59.89
1.72	53.5	44.78	29.62	4	66.38
4.03	42.6	53.37	25.7	6.4	67.9
6.30	35.5	58 2	21.08	11	67.92
8.29	31	60.71	19.15	13.2	67.65
10.35	27	62.65	18.18	14.7	67.12
14.2	20.5	65.3	14.2	20.5	65.3*

* Plait point. † Quad. point.

The authors give a complete summary of previous investigations of this system by de Bruyn (1899, 1900); Bell (1905); Cuno (1908–09).

Data for the conjugated liquid layers obtained in the system potassium carbonate, ethyl alcohol and water at 17° and at 35° are given by de Bruyn (1900) and at 20°, 40° and 60° by Cuno (1908).

COMPOSITION OF THE CONJUGATED LIQUIDS WHICH ARE IN EQUILIBRIUM WITH SOLID POTASSIUM CARBONATE (QUADRUPLE POINTS) AT VARIOUS TEMPERATURES.

(de Bruyn, 1900)

t°.	Gms. per 100 Gms. Upper Layer.			Gms. per 100 Gms. Lower Layer.		
	K_2CO_3.	C_2H_5OH.	H_2O.	K_2CO_3.	C_2H_5OH.	H_2O.
−18	0.03	90.3	9.7	51.2	0.2	48.6
0	0.04	91.9	8.1	51.3	0.2	48.5
+17	0.06	91.5	8.4	52.1	0.2	47.7
35	0.07	90.9	9	53.4	0.2	46.4
50	0.09	91.8	8.1	55.3	0.2	44.5
75	0.12	91.4	8.5	57.9	0.2	41.9

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE, METHYL ALCOHOL, WATER AT 23°–26°.

(Frankforter and Frary, 1913.)

The authors give the data for the binodal curve and the quadruple points but tie lines, other than for the quadruple points, were not determined.

Gms. per 100 Gms. Homogeneous Liquid.			Gms. per 100 Gms Homogeneous Liquid.		
K_2CO_3.	CH_3OH.	H_2O.	K_2CO_3.	CH_3OH.	H_2O.
6.32	75.85	17.83*	21.61	33 43	44.96
6.91	63.13	29.97	23.15	31.26	45 60
8.07	59.26	32.67	28.25	23.82	47.94
10.17	52.64	35 33	30.72	20 57	48.71
12.03	49.97	37 99	32.92	17.27	49.80
14.24	45.74	40.02	40.65	9 26	50.09
16.48	41.76	41.76	43 95	6.96	49.09
18.89	37.76	43.36	45 89	6 42	47.69
			49.05	6.1	44.88†

* Upper quad. point. † Lower quad point.

The following results for the solubility of K_2CO_3 in concentrations of aq. CH_3OH above and below those yielding liquid layers are also given.

Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.	
CH_3OH.	K_2CO_3.	CH_3OH.	K_2CO_3.
1.03	51.39	85	2.05
2.22	50.33	89.2	1.56
6.1	49.05 (Lower quad. pt.)	91	1 98
Two Liquid Layers Formed Here.		93.6	2.72
75.85	6.32 (Upper quad pt).	94.3	5 7 (Abs. CH_3OH).

Data for the binodal curves for this system at 17° and at 35° are given by de Bruyn (1900).

This author also gives the following data for the composition of the conjugated liquids in equilibrium with solid potassium carbonate (quadruple points) at various temperatures.

t°.	Gms per 100 Gms Upper Layer.			Gms per 100 Gms. Lower Layer.		
	K_2CO_3.	CH_3OH.	H_2O.	K_2CO_3.	CH_3OH.	H_2O.
−30	21.7	42.2	36.1	...	...	...
−20	13.8	52.1	34.1	...	...	...
−20	12.4	...	...	44.2	8.2	47.6
0	7.6	66.3	26.1	46.3	6.7	47
0	7.4	...	...	46.6	6.6	46.8
+17	6.2	69.6	24.2	48.3	5.7	46
35	5	72.9	22.1	51	4.3	44.7

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE, NORMAL PROPYL ALCOHOL AND WATER AT 22°–26°.

(Frankforter and Frary, 1913.)

The authors give the data for the binodal curve and the quadruple points but tie lines were not located.

Gms. per 100 Gms. Homogeneous Liquid.			Gms. per 100 Gms. Homogeneous Liquid.		
K_2CO_3.	C_3H_7OH.	H_2O.	K_2CO_3.	C_3H_7OH.	H_2O.
52.9	0.02	47.08*	7.45	9.30	83 25
46.98	0.12	52.91	5.97	11 07	82 96
39	0.20	60.80	4.73	12 71	82.56
34.58	0.20	65.15	3 86	14.60	81 54
30.43	0.45	69.12	3.11	17.17	79.71
26.51	0.78	72.71	2.42	24.71	72.87
22.81	1.32	75 87	1.91	34 90	63.19
19 08	2.31	78 62	1.71	39	59.29
16 35	3 24	80.41	1.33	45.57	53.09
13.47	4 41	82 12	0.948	51.56	47.49
10 99	6 24	82 77	0 387	64.20	35.41
8.55	8.31	83 14	0.017	95 83	4.153†

* Lower quad. point. † Upper quad. point.

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE, ISOPROPYL ALCOHOL AND WATER AT 20°.

(Frankforter and Temple, 1915)

NOTE. — The results for the binodal curve in this and the following system are reported in terms of gms. per 100 gms. solvent (water + alcohol) instead of gms. per 100 gms. of homogeneous liquid (K_2CO_3 + water + alcohol.)

Gms. per 100 Gms. Alcohol + Water.			Gms. per 100 Gms Alcohol + Water.		
K_2CO_3	Alcohol.	Water.	K_2CO_3.	Alcohol.	Water.
44 844	2 911	97 089	15 021	19 445	80 555
36.137	4.783	95 217	13 244	23 919	76 081
28 879	7 349	92 651	6 065	45.397	54 603
24.152	9 159	90 841	3 933	53.265	46 735
17 665	14 395	85 605	2 954	57 294	42.706

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE, ALLYL ALCOHOL AND WATER AT 20°.

(Frankforter and Temple, 1915)

Gms. per 100 Gms Alcohol + Water.			Gms per 100 Gms Alcohol + Water.		
K_2CO_3.	Alcohol.	Water	K_2CO_3.	Alcohol	Water.
47 746	2.103	97 897	8 239	30 677	69 323
33.200	5.267	94 733	5 521	39 337	60 663
23 486	9 309	90 691	2 020	54 487	45 513
16.354	15 037	84 963	1 015	62 610	37 390
11.331	22 454	77 546	0 0853	81.228	18 772

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE, ACETONE, WATER AT 20°.

(See also Acetone, p. 13). (Frankforter and Cohen, 1914)

The binodal curve was very carefully determined and, in addition, data for the quadruple points (solid K_2CO_3) and five tie lines were located. These data were plotted and the following interpolated values for the conjugated liquids read from the curve.

Gms. per 100 Gms Upper Layer			Gms. per 100 Gms. Lower Layer.		
K_2CO_3.	$(CH_3)_2CO$.	H_2O	K_2CO_3.	$(CH_3)_2CO$.	H_2O
0.0024	96.4	3 5+†	52 4	trace	47.6†
0 039	64	35 96	32 63	1.2	66.17
0.712	55.3	43 99	24 4	3 7	71.9
1.36	48.5	50.14	22 91	4 7	72.39
4.57	34	61 43	16 92	10 2	72.88
6.97	27.5	65 53	14 77	13	72.23
10.5	20	69.5*	10 5	20	69.5

* Plait point. † Quad. points.

EQUILIBRIUM IN THE SYSTEM POTASSIUM CARBONATE, POTASSIUM DIPROPYL MALONATE AND WATER AT 25°.
(M'David, 1909-10.)

A series of mixtures of $K_2CO_3 + KC_{11}H_{19}O_4 + H_2O$ were prepared and thoroughly mixed. They were placed in a thermostat at 25° and the two layers which separated in each case, were analyzed.

Gms. per 100 Gms. Upper Layer.			Gms. per 100 Gms. Lower Layer.		
K_2CO_3.	$KC_{11}H_{19}O_4$.	H_2O.	K_2CO_3.	$KC_{11}H_{19}O_4$.	H_2O.
4.05	65 1	30.85	42.6	0.4	57
4.9	59 8	35 3	40.7	0.4	58.9
5.6	53 5	40 9	35	0.5	64 5
7.2	50 5	42 3	33 5	0.9	65.6
8.7	39 2	52 1	28 9	0 7	70.4
11	34 6	54 4	26 8	0 8	72.4
14.5	23.5	62	24.8	3	72.2
17	18 6	64.4	23 1	6.05	70 85
18.6	15	66 4	21.7	8.7	69.6

Several determinations at 2° and at 56° are also given.

100 cc. anhydrous hydrazine dissolve 1 gm. K_2CO_3 at room temp. (Welsh and Broderson, 1915.)

100 gms. aqueous solution simultaneously sat. with K_2CO_3 and cane sugar at 31.25° contain 22.24 gms. K_2CO_3 and 56 gms. sugar. (Kohler, 1897.)

Freezing-point data for mixtures of K_2CO_3 + KCl and K_2CO_3 + NaCl (Sackur, 1911-12). $K_2CO_3 + K_2SO_4$ (Amadori, 1912; Le Chatelier, 1894); $K_2CO_3 + Na_2CO_3$ (Le Chatelier, 1894). (Le Chatelier, 1894.)

POTASSIUM Sodium CARBONATE $K_2CO_3.Na_2CO_3.12H_2O$.

SOLUBILITY IN WATER AT 25°.
(Osaka, 1910-11.)

Gms. per 100 Gms Sat Sol. K_2CO_3	Na_2CO_3.	Solid Phase.	Gms per 100 Gms Sat Sol K_2CO_3	Na_2CO_3	Solid Phase.
52.83	0	$K_2CO_3.2H_2O$	25.2	14 1	$K_2CO_3.Na_2CO_3.12H_2O$
52	1	"	22.4	16.6	"
50 7	2 6	"	19 8	18 7	"
49.1	4 6	" $+K_2CO_3.Na_2CO_3.12H_2O$	19 1	19 7	"
49	4 6	$K_2CO_3.Na_2CO_3.12H_2O$	15.1	23 2	" $+Na_2CO_3.10H_2O$
46.5	4.3	"	14 5	22 8	$Na_2CO_3.10H_2O$
46 2	5 2	"	10 8	22 7	"
41	6 3	"	10 7	22 4	"
37.7	7	"	4 7	21 9	"
31	10 5	"	0	22 71	"

The previous determinations of Kremann and Zitek (1909), agree in general with the above, but these authors report that the double salt contains $6H_2O$ instead of $12H_2O$.

100 gms. H_2O dissolve 184 gms. potassium sodium carbonate at 15° (d = 1.366). (Stolba, 1865.)

POTASSIUM URANYL CARBONATE $2K_2CO_3.(UO_2)CO_3$.

100 gms. H_2O dissolve 7.4 gms. salt at 15°. (Ebelmen, 1852.)

POTASSIUM CHLORATE $KClO_3$.

SOLUBILITY IN WATER.

Average curve from results of Carlson (1910), Calzolari (1912), and Tschugueff and Chlopin (1914).

t°.	d of Sat. Sol.	Gms. $KClO_3$ per 100 Gms. H_2O.	t°.	d of Sat. Sol.	Gms. $KClO_3$ per 100 Gms. H_2O.
0	1.021	3.3	40	1 073	14
10	...	5	50	.	19.3
15	...	6 1	60	1 115	24.5
20	1.045	7.4	80	1.165	38.5
25	...	8.8	100	1.219	57
30	...	10 5	104 b. pt.	1.230	60

For previous results in good agreement with the above, see next page.

POTASSIUM CHLORATE $KClO_3$. (See also previous page.)

SOLUBILITY IN WATER.

(Gay-Lussac, 1819; Pawlewski, 1899; above 100°, Tilden and Shenstone, 1881; see also Blarez, 1891; Étard, 1894; at 99°, Köhler, 1879.)

t°.	Gms. $KClO_3$ per 100 Gms. Solution.	Water		t°.	Gms. $KClO_3$ per 100 Gms. Solution.	Water.	
0	3.04	3.14	3.3*	70	22.55	29.16	32.5*
10	4.27	4.45	5.0	80	26.97	36.93	39.6
20	6.76	7.22	7.1	90	31.36	46.11	47.5
25	7.56	8.17	8.6	100	35.83	55.54	56.0
30	8.46	9.26	10.1	120	42.4	73.7	73.7
40	11.75	13.31	14.5	136	49.7	98.5	99.0
50	15.18	17.95	19.7	190	64.6	183.0	183.0
60	18.97	23.42	26.0	330	96.7	2930.00	...

* Gay Lussac.

100 gms. H_2O dissolve 5.06 gms. $KClO_3$ at 10°. (Roozeboom, 1891.)
One liter of H_2O dissolves 65.5 gms. $KClO_3$ at about 20°. (Konowalow, 1899b.)
One liter of 5.2% NH_3 solution dissolves 52.5 gms. $KClO_3$ at about 20°. "

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF POTASSIUM HYDROXIDE, HYDROGEN PEROXIDE, AND MIXTURES OF THE TWO AT 25°.

(Calvert, 1901.)

The mixtures were agitated by means of a stream of air. Equilibrium was approached both from above and below 25°.

Composition of Solvent.	Mols $KClO_3$ Dissolved per Liter of Sat. Sol.	Gms. $KClO_3$ Dissolved per Liter of Sat. Sol.
Water alone	0.675	82.71
Aqueous 0.125 *n* KOH	0.625	76.60
" 0.25 *n* "	0.573	70.23
Aq. H_2O_2 containing 1.26 mols. H_2O_2 per l.	0.730	89.45
" " 1.31 " "	0.737	90.33
Aq. 0.25 *n* KOH " 0.015 " "	0.578	70.82
" " 0.276 " "	0.584	71.57
" " 0.954 " "	0.616	75.50
" " 1.073 " "	0.673	82.47

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF POTASSIUM BROMIDE AT 13°. (Blarez, 1911.)

Gms. per 100 Gms. Solution. KBr.	$KClO_3$.	Gms. per 100 Gms. Solution. KBr.	$KClO_3$.	Gms. per 100 Gms. Solution. KBr.	$KClO_3$.
0.20	5.18	1.0	5.04	6.0	3.46
0.60	5.20	2.0	4.60	8.0	2.80
0.8	5.06	3.0	4.2	10.0	2.40
		4.0	4.0		

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF OTHER POTASSIUM SALTS AT 14°–15°. (Blarez, 1911.)

Salt.	Gms. per 100 Gms. Solution. K Salt.	$KClO_3$.	Salt.	Gms. per 100 Gms. Solution. K Salt.	$KClO_3$.
KOH	1.43	4.47	KNO_3	2.59	4.51
KCl	1.91	4.45	"	5.18	3.88
"	3.82	3.58	K_2SO_4	2.23	4.71
KBr	3.05	4.49	"	4.46	3.98
"	6.10	3.60	$K_2C_2O_4$	2.42	4.72
KI	4.25	4.59	"	4.85	3.93
"	8.51	3.65			

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE AT 20°.

(Winteler — Z. Electrochem. 7, 360, '00.)

Sp. Gr. of Solutions.	Grams per Liter. KCl.	Grams per Liter. $KClO_3$.	Sp. Gr. of Solutions.	Grams per Liter. KCl.	Grams per Liter. $KClO_3$.
1.050	0	71.1	1.098	120	24.5
1.050	10	58.0	1.108	140	22.5
1.050	20	49.0	1.119	160	21.0
1.054	40	39.5	1.130	180	20.0
1.064	60	34.0	1.140	200	20.0
1.075	80	30.0	1.168	250	20.0
1.086	100	27.0			

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE.

(Arrhenius — Z. physik. Chem. 11, 397, '93.)

Results at 19.85°.				Results at 23.87°.			
Mols. per Liter. KNO_3.	Mols. per Liter. $KClO_3$.	Grams per Liter. KNO_3.	Grams per Liter. $KClO_3$	Mols. per Liter. KNO_3.	Mols. per Liter. $KClO_3$	Grams per Liter. KNO_3.	Grams per Liter. $KClO_3$.
0.0	0.570	0.0	69.88	0.0	0.645	0.0	79.09
0.125	0.529	12.65	64.86	0.5	0.515	50.59	63.14
0.25	0.492	25.29	60.33				
1.0	0.374	101.19	45.85				
2.0	0.328	202.38	40.22				

SOLUBILITY OF POTASSIUM CHLORATE:

(Taylor, 1897; see also Gerardin, 1865.)

Wt. per cent Alcohol or of Acetone in Solvent.	In Aqueous Alcohol. At 30°. Gms. $KClO_3$ per 100 Gms Solution.	At 30°. Water.	At 40°. Gms. $KClO_3$ per 100 Gms Solution.	At 40°. Water.	In Aqueous Acetone. At 30°. Gms. $KClO_3$ per 100 Gms Solution.	At 30°. Water.	At 40°. Gms. $KClO_3$ per 100 Gms Solution.	At 40°. Water.
0	9.23	10.17	12.23	13.93	9.23	10.17	12.23	13.93
5	7.72	8.80	10.48	12.33	8.32	9.56	11.10	13.11
10	6.44	7.65	8.84	10 77	7.63*	9.09	10.28*	12.60
20	4.51	5 90	6.40	8 56	6.09	8.10	8.27	11.26
30	3.21	4 74	4 67	7 00	4.93	7.40	6.69	10.24
40	2.35	4.00	3.41	5.88	3.90	6.76	5.36	9.45
50	1.64	3.33	2.41	4 94	2.90	5 98	4.03	8.40
60	1.01	2.53	1.41	3.69	2.03	5.17	2.86	7.35
70	0.54	1.82	0.78	2.63	1.24	4.18	1.68	5.68
80	0.24	1.22	0.34	1.73	0.57	2.88	0.79	3.97
90	0.06	0.62	0.12	1.17	0.18	1.82	0.24	2.45

* Solvent, 9.09 Wt. per cent Acetone.

100 gms. sat. solution of $KClO_3$ in glycol contain 0.9 gms. $KClO_3$.

(de Coninck, 1905.)

SOLUBILITY OF POTASSIUM CHLORATE IN AQUEOUS SOLUTIONS OF VARIOUS COMPOUNDS AT 25°. (Rothmund, 1910)

Aqueous 0.5 Normal Solution of:	$KClO_3$ per Liter. Mols.	Gms.	Aqueous 0.5 Normal Solution of:	$KClO_3$ per Liter. Mols.	Gms.
Water alone	0.1475	20.44	Ammonia	0.1474	20.43
Methyl Alcohol	0.1402	19.43	Dimethylamine	0.1342	18.60
Ethyl Alcohol	0.1356	18.75	Pyridine	0.1410	19.54
Propyl Alcohol	0.1343	18.61	Urethan	0.1400	19.40
Tertiary Amyl Alcohol	0.1279	17.72	Formamide	0.1539	21.32
Acetone	0.1451	20.11	Acetamide	0.1447	20.05
Ether	0.1336	18.51	Acetic Acid	0.1462	20.26
Glycol	0.1416	19.62	Phenol	0.1362	18.87
Glycerol	0.1404	19.45	Methylal	0.1400	19.40
Urea	0.1510	20.92	Methyl Acetate	0.1429	19.80

100 gms. glycerol (d_{15} = 1.256) dissolve 3.54 gms. $KClO_3$ at 15–16°. (Ossendowski, 1907.)

POTASSIUM PerCHLORATE $KClO_4$.

SOLUBILITY IN WATER.

(Average curve from results of Noyes and Sammet (1903); Carlson (1910); Rosenheim and Weinhaber (1910–11); Calzolari (1912); Thin and Cumming (1915).

t°.	d of Sat. Sol.	Gms $KClO_4$ per 100 Gms H_2O.	t°.	d of Sat. Sol.	Gms. $KClO_4$ per 100 Gms Sat Sol.
0	1.007	0.75	50	...	6.5
10	...	1.05	60	1.033	9
20	1.011	1.80	70	...	11.8
25	1.012	2.08	80	1.053	14.8
30	...	2.6	90	...	18
40	1.022	4.4	100	1.067	21.8

SOLUBILITY OF POTASSIUM PERCHLORATE IN AQUEOUS AND IN ALCOHOLIC SOLUTIONS OF PERCHLORIC ACID AT 25.2°.

(Thin and Cumming, 1915)

In Aq. $HClO_4$ Solutions. Normality of Aq. $HClO_4$.	Gms $KClO_4$ per 100 Gms Sat. Sol.	In Alcoholic $HClO_4$ Solutions. Aqueous Solvent.	Gms $KClO_4$ per 100 Gms Sat. Sol.
0 (= water)	2.085	93.5% Alcohol	0.051
0.01	1.999	" +0.2% $HClO_4$*	0.0175
0.10	1.485	98.8% Alcohol + "	0.010
1	0.527	" +2% $HClO_4$*	0.028

* The $HClO_4$ was added as aq. 20% $HClO_4$ solution hence the concentration of the alcohol was decreased.

SOLUBILITY OF POTASSIUM PERCHLORATE IN AQ. KCl AND AQ. K_2SO_4 SOLUTIONS AT 25°. (Noyes and Boggs, 1911.)

In Aq. KCl Solutions. Gms. per 100.2 cc. Sat. Sol. $KClO_4$.	KCl.	Wt. of 100.2 cc. of Solution.	In Aq. K_2SO_4 Solutions. Gms. per 100.2 cc Sat. Sol. $KClO_4$.	K_2SO_4.	Wt. of 100.2 cc. of Solution.
2.0566	0	...	2.0566	0	...
1.7800	0.3715	101.42	1.8262	0.4339	101.47
1.5597	0.7421	101.45	1.6396	0.8665	101.55

100 gms. 51.2 Vol. % Aq. C_2H_5OH (d=0.9319) dissolve 0.754 gm. $KClO_4$ at 25.2°. (Thin and Cumming, 1915)

" 93.5 " " (d=0.8219) " 0.051 gm. $KClO_4$ at 25.2°. (Thin and Cumming, 1915.)

" 98.8 " " (d=0.7998) " 0.019 gm. $KClO_4$ at 25.2°. (Thin and Cumming, 1915)

" 90 Wt. % Aq. C_2H_5OH " 0.036 gm. $KClO_4$ at 25.2°. (Wenze, 1891.)

" 97.2 " " " 0.0156 gm. $KClO_4$ at 25.2°. (Wenze, 1891.)

POTASSIUM CHLORIDE KCl.

SOLUBILITY IN WATER.

(Average curve from the results of Meusser — Z. anorg. Chem. 44, 79, '05; at 31.25°, Köhler — Z. Ver. Zuckerind. 47, 447, '97; Andrae — J. pr. Chem. [2] 29, 456, '84; Gerardin — Ann. chim. phys. [4] 5, 137, '65, de Coppet Ibid [5] 30, 411, '83; Etard Ibid. [7] 2, 526, '94; Mulder; above 100°, Tilden and Shenstone — Proc. Roy. Soc. (Lond.) 35, 345, '83.)

t°.	Gms KCl per 100 Gms. Solution.	Water.	t°.	Gms. KCl per 100 Gms. Solution	Water.	t°.	Gms. KCl per 100 Gms. Solution.	Water.
−9	19.3	23.9	40	28.6	40.0	147	41.5	70.8
−4.5	20.6	25.9	50	29.9	42.6	180	43.7	77.5
0	21.6	27.6	60	31.3	45.5		Solid Phase Ice	
5	22.7	29.3	70	32.6	48.3	−9	19.3	23.9
10	23.7	31.0	80	33.8	51.1	−8.	17.7	21.5
15	24.5	32.4	90	35.1	54.0	−8	16.7	20.0
20	25.4	34.0	100	36.2	56.7	−7	14.9	17.5
25	26.2	35.5	130	39.8	66.0	−6	13.6	15.7
30	27.1	37.0				−5.5	12.5	14.3

Sp. Gr. of solution sat. at 0 = °1.150; at 15° = 1.172.

The following determinations of the solubility of potassium chloride in water, made with exceptional care, are reported by Berkeley (1904).

t°.	*d* of Sat. Sol.	Gms. KCl per 100 Gms. H_2O.	t°.	*d* of Sat Sol.	Gms. KCl per 100 Gms. H_2O.
0.70	1.1540	28.29	74.80	1.2032	49.58
19.55	1.1738	34.37	89.45	1.2069	53.38
32.80	1.1839	38.32	108 (b. pt.)	1.2118	58.11
59.85	1.1980	45.84			

100 gms. H_2O dissolve 36.12 gms. KCl at 25°. (Amadori and Pampanini, 1911.)
F.-pt. data for aq. KCl solutions are given by Roloff (1895).
Data for equilibrium in the system potassium chloride, arsenic trioxide and water at 30° are given by Schreinemakers and de Baat (1915).

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AT 0° AND AT 25°.

(Armstrong, Eyre, Hussey and Paddinson, 1907; Armstrong and Eyre, 1910–11.)

Solvent, Gms. HCl per 1000 Gms. H_2O.	Gms KCl per 100 Gms. Sat Sol. At 0°.	At 25°.
0	22.11	26.45
9.11	20.93	25.17
18.22	19.71	24.07
36.45	17.26	21.74
109.35	...	13.47
182.25	...	6.93

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROBROMIC ACID AND OF HYDROCHLORIC ACID AT 25°. (Herz, 1911–12.)

In Aq. HBr. Millimols per 10 cc. HBr.	KCl.	Gms per Liter. HBr.	KCl.	In Aq. HCl. Millimols per 10 cc. HCl.	KCl.	Gms. per Liter. HCl.	KCl.
0	42.72	0	318.5	5.66	37.49	20.64	279.6
6.61	37.80	53.5	281.9	10.20	33.79	37.19	252
34.15	19.57	276.4	146	15.91	28.68	57.98	213.9
				20.94	24.74	76.35	146.6
				32.52	17.39	118.6	129.6

Solubility of Potassium Chloride in Aqueous Solutions of Hydrochloric Acid at 0°.

(Jeannel — Compt. rend. 103, 381, '86; Engel — Ann. chim. phys. [6] 13, 377, '88.)

Milligram Mols. per 10 cc. KCl.	Milligram Mols. per 10 cc. HCl.	Grams per 100 cc. Solution. KCl	Grams per 100 cc. Solution. HCl.	Sp. Gr. of Solutions.
34.5	0.0	25.73	0 0	1.159
30.41	3.9	22.69	1.42	1.152
27.95	6.6	20.84	2.41	1.150
27.5	7.1	20.51	2.59	1.147
23.75	11.1	17.71	4 05	1.137
16.0	23.0	11 93	8.39	1.111
10.0	34.0	7 46	12.40	1.105
7.5	41.0	5 60	14.95	1.105
2.0	65.5	1.49	23.88	1.121
2.4	148.8 (sat.)	1.52	54.26	1.224

100 cc. saturated HCl solution dissolve 1.9 gms. KCl at 17°. (Ditte, 1881.)
100 gms. sat. aq. HCl solution dissolve 1.9 gms. KCl at 20°. (Stoltzenberg, 1912.)
F.-pt. data for mixtures of KCl and HCl are given by Dernby (1918).

Solubility of Mixtures of Potassium Chloride and of Sodium Chloride in Aqueous Hydrochloric Acid Solutions at 25°.

(Hicks, 1915)

Gms. per 100 Gms. Sat. Solutions. HCl.	NaCl.	KCl.
0	19.95	10.90
8.61	10.65	7.58
17.16	3.56	3.80
20.65	2.03	2.86
32.78	0.18	1.27

Solubility of Potassium Chloride in Aqueous Magnesium Chloride Solutions.

(Precht and Wittgen — Ber. 14, 1667, '81)

t°.	Grams KCl per 100 Grams Sat. Solution in: 11% $MgCl_2$.	15% $MgCl_2$.	21.2% $MgCl_2$.	30% $MgCl_2$.	20% $MgCl_2$.
10	14.3	9.9	5.3	1.9	4.2 KCl+5.7 NaC
20	15.9	11.3	6.5	2.6	6.0 " +5.9 "
30	17.5	12.7	7.6	3.4	6.9 " +6.0 "
40	19.0	14.2	8.8	4.2	7.9 " +6.1 "
50	20.5	15.6	10.0	5.0	8.9 " +6.3 "
60	21.9	17.0	11.2	5.8	9.9 " +6.4 "
80	24.5	19.5	13.6	7.3	10.9 " +6.6 "
90	25.8	20.8	14.7	8.1	11.9 " +6.7 "
100	27.1	22.1	15.9	8.9	13.0 " +6.9 "

More recent data on the solubility of potassium chloride in aqueous solutions of magnesium chloride are given by Feit and Przibylla (1909).

SOLUBILITY OF MIXTURES OF POTASSIUM CHLORIDE AND POTASSIUM BROMIDE AT 25°.

(Fock, 1897.)

Grams per Liter Solution. KBr.	Grams per Liter Solution. KCl	Milligram Mols. per Liter KBr.	Milligram Mols. per Liter KCl.	Mol. per cent KCl in Solution.	Sp. Gr. of Solutions.	Mol. per cent KCl in Solid Phase.
558.1	0.00	4686.2	0.0	0.0	1.3756	0.00
531.5	23.44	4462.7	314.2	6.16	1.3700	0.00
503.6	46.57	4228.5	624.3	12.86	1.3648	8.23
454.6	82.62	3817.8	1108.0	22.49	1.3544	15.68
379.6	136.6	3188.1	1830.7	36.48	1.3320	33.66
324.8	166.9	2727.6	2237.4	45.06	1.3119	63.51
218.0	213.9	1830.2	2868.0	60.30	1.2689	82.29
140.7	250.9	1181.1	3363.9	74.01	1.2455	88.04
47.5	291.7	398.8	3911.4	85.22	1.1977	96.98
0.0	311.3	0.0	4173.1	100.00	1.1756	100.00

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS POTASSIUM HYDROXIDE SOLUTIONS.

(Engel — Bull soc. chim. [3] 6, 16, '91; Winteler — Z. Electrochem. 7, 360, '00)

Results at 0°.

(Engel)

Mg. Mols. per 10 cc Solution KCl	Mg. Mols. per 10 cc Solution KOH.	Sp. Gr. of Solution.	Gms. per 100 cc. Solution. KCl.	Gms. per 100 cc. Solution. KOH.
35.5	0	1.159	26.83	0.0
31.0	2.375	1.146	23.44	1.33
28.3	4.7	1.153	21.39	2.64
23.0	9.9	1.172	17.39	5.56
18.38	15.1	1.195	13.89	8.46
14.43	20.0	1.216	10.91	11.23
11.43	24.63	1.239	8.64	13.83
8.98	29.25	1.261	6.78	16.43
6.28	35.13	1.294	4.74	19.72

Results at 20°.

(Winteler)

Gms. per 100 cc. Solution. KCl.	Gms. per 100 cc. Solution. KOH.	Sp. Gr. of Solution.
29.3	1.0	1.185
21.1	10.0	1.210
14.8	20.0	1.245
10.4	30.0	1.295
6.8	40.0	1.345
4.0	50.0	1.397
2.2	60.0	1.450
1.4	70.0	1.500
1.1	80.0	1.550
0.9	85.0	1.580

SOLUBILITY OF MIXTURES OF POTASSIUM CHLORIDE AND POTASSIUM IODIDE IN WATER.

(Etard — Ann. chim. phys. [7] 3, 275, '94)

t°.	Grams per 100 Gms Solution. KCl.	Grams per 100 Gms Solution. KI.	t°.	Grams per 100 Gms. Solution. KCl.	Grams per 100 Gms. Solution. KI.
0	3.7	50.5	100	6.2	61.0
20	4.2	53.0	140	7.3	63.7
40	4.7	55.3	180	8.3	65.5
60	5.2	57.5	220	9.4	66.3
80	5.7	59.4	245	10.0	66.5

Solubility of Potassium Chloride in Aqueous Solutions of Potassium Iodide at 25° and Vice Versa.

(Amadori and Pampanini, 1911.)

Gms. per 100 Gms H_2O.		Gms. per 100 Gms H_2O.	
KCl.	KI.	KCl.	KI.
0	149.26	19.64	68.22
4.06	144.03	23.75	43.89
7.63	137.79	29.56	23.83
11.36	132.60	31.38	14.83
11.74	133.90	33.68	7
15.10	105.91	36.12	0

Solubility of Potassium Chloride in Aqueous Solutions of Potassium Nitrate at 0° and at 25°.

(Armstrong and Eyre, 1910–11)

Solvent, Gms. KNO_3 per 1000 Gms. H_2O.	Gms KCl Dissolved per 100 Gms Sat Solution at:	
	0°.	25°.
0	22.10	26.73
25.27	21.71	26.26
50.55	21.25	25.61
101.11	20.70	24.58
151.66	...	23.57

Solubility Data for the Reciprocal Salt Pairs $KCl+NaNO_3 \rightleftarrows NaCl+KNO_3$ at 5°, 25°, 50° and 100°.

(Reinders, 1914, 1915, see also Uyeda, 1909–10.)

Results at 25°. Gms per 100 Gms H_2O				Results at 50°. Gms per 100 Gms H_2O.				Solid Phase in Each Case
NaCl	KCl.	$NaNO_3$	KNO_3	NaCl	KCl	$NaNO_3$.	KNO_3.	
36.04	...	...	...	36.72	...	...	...	NaCl
32.28	10	...	...	...	.	...	..	"
30.27	16.45	...	...	28.35	23.09	...	...	NaCl+KCl
12	26.78	...	...	...	42.80	...	...	KCl
...	35.54	...	10	..	41.39	...	24.05	"
...	34.92	...	22.79	...	38.75	...	52.54	$KCl+KNO_3$
...	10	...	31.48	....	...	...	85.10	KNO_3
...	...	10	37.49	...	...	...	...	"
...	...	60	41.87	...	...	...	...	"
...	...	100.9	46.15	...	...	134.9	90.2	KNO_3+NaNO_3
...	...	96.06	20	...	...	114.1	...	$NaNO_3$
10	...	77.46	...	. .	...	. .	..	"
23.62	...	58.01	. .	20.5	...	84.8	...	$NaNO_3+NaCl$
33.90	...	10	...	28.4	...	43.9	..	NaCl
24.82	22.2	15.4	...	34	13.4	...	24.3	NaCl+KCl
21.36	20	...	32.9	12.7	25.4	...	58.6	$KCl+KNO_3$
24.5	...	61.3	17.2	..	...	...	...	KNO_3+NaNO_3
7	...	82.1	43.15	19.2	...	104.1	27.2	$NaNO_3+NaCl$
23.8	...	64	41.2	12.2	...	110.7	82.2	$NaCl+NaNO_2+KNO_3$
4.5	...	...	40.3	59.9	...	6.1	70.9	$NaCl+KCl+KNO_3$
Results at 5°.				**Results at 100°.**				
31.50	10.4	...	...	27.3	36.2	...	...	NaCl+KCl
...	29.84	...	10.14	...	41.6	...	199	$KCl+KNO_3$
...	...	82.10	18.1	...	..	233.6	218	KNO_3+NaNO_3
[illegible]		[illegible]	...	10.2	...	158	...	$NaNO_3+NaCl$

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE, AND OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE, AT SEVERAL TEMPERATURES.

(Touren, 1900; Bodländer, 1891; Nicol, 1891; Soch, 1898.)

KCl in Aq. KNO_3 Solutions at:

14.5° (T.). Gms. per Liter Solution.		25.2° (T.). Gms. per Liter Solution.		20°, etc. (N.). Gms. per 1000 Gms. H_2O.	
KNO_3.	KCl.	KNO_3.	KCl.	KNO_3.	KCl.
0	288.3	0	311.8	0	345.2
20.64	284.2	13.76	306.6	56.18	342.15
32.18	282.1	32.18	303.6	168.54	334.39
62.23	276.8	91.26	293.2	at 25° (S)	
82.77	273.5	122.7	287.2	225.8	341.3
115.9	270.7	141.4	284.2	at 80° (S)	
119.1	268.3	182.7	276	1175	402
123.4	267.2				

KNO_3 in Aq. KCl Solutions at:

14.5°. Gms. per Liter Solution.		25.2°. Gms. per Liter Solution.		20°. Gms. per 1000 Gms H_2O.	
KCl.	KNO_3.	KCl.	KNO_3.	KCl.	KNO_3.
0	225.4	0	325.5	0	311.1
13.58	219.8	19.39	312.3	82.9	256.8
31.63	208.2	49.22	288.7	165.8	221.7
65.64	185.2	100.7	254	248.7	202
132.6	159.5	155.2	224.4	310.8	501.6
164.4	153.3	207.3	203.9		
196.5	144	226.8	196.9		
236.9	137.1				

In the case of the results by Touren, constant temperature and agitation were employed.

KNO_3 in Aq. KCl at 20.5° (B.).

Gms. per 100 cc. Solution. KCl.	KNO_3.	Sp. Gr of Solutions.
0	27 68	1.1625
4.72	24.39	1.1700
7.74	22.44	1.1765
12.23	20.23	1.1895
15.15	18.96	1.1983
19.61	17.67	1.2150
22.17	17.11	1.2265
24.96	16.79	1.2400

KCl in Aq. KNO_3 at 17.5° (B.).

Gms. per 100 cc. Solution. KNO_3.	KCl.	Sp. Gr. of Solutions.
0	29.39	1.1730
6.58	27.50	1.1980
8.88	27.34	1.2100
12.48	26.53	1.2250
14.83	25.98	1.2360
15.22	25.96	1.2390
15.49	25.95	1.2388
15.33	26.24	1.2410

In the case of the above results by Bodländer, a saturated aqueous solution of potassium chloride was prepared and weighed amounts of potassium nitrate were added to measured volumes of it. The mixtures were warmed and then allowed to cool to the indicated temperature and frequently shaken during 24 hours.

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF POTASSIUM NITRATE AND VICE VERSA.

(Leather and Mukerji, 1913.)

Results at 30°.			Results at 40°.			Results at 91°.			
Sp. Gr. Sat. Sol.	Gms. per 100 Gms. H_2O. KCl.	KNO_3.	Sp. Gr. Sat. Sol.	Gms. per 100 Gms. H_2O. KCl.	KNO_3.	Sp. Gr. Sat. Sol.	Gms. per 100 Gms. H_2O KCl.	KNO_3.	Solid Phase in Each Case.
1.186	37.58	0	1.194	40.60	0	1.222	53.58	0	KCl
1.219	36.72	8.05	1.252	39.11	16.86	1.344	47.85	52.75	"
1.251	36.19	19.36	1.305	37.08	35.45	1.486	43.30	114.6	"
1.281	35.42	26.83	1.319	37.49	39.71	1.552	39.90	162.9	" + KNO_3
1.258	28.71	29.19	1.312	32.22	41.52	1.544	33.25	165.6	KNO_3
1.241	19.35	32.34	1.297	22.63	46.31	1.545	15.56	181.1	"
1.225	9.44	38.10	1.279	11.58	52.66	1.552	0	202.8	"

Results are also given for 20°.

SOLUBILITY OF MIXTURES OF POTASSIUM CHLORIDE AND SODIUM CHLORIDE IN WATER.

t°.	Gms. per 100 Gms. H_2O. KCl.		NaCl.		t°.	Gms. per 100 Gms. H_2O. KCl.		NaCl.	
0	11.2(1)	11.2(2)	30(1)	30(2)	50	22(1)	19(2)	27.7(1)	32.3(2)
10	12.5	12.3	29.7	30.5	60	24.6	20.6	27.2	32.8
20	14.7	13.8	29.2	31	70	27.3	32.5	26.8	34.1
25	17.1(3)	14.5	29(3)	31.3	80	31 (3)	25.2(3)	26.4(3)	34
30	17.2	15.4	28.7	31.5	90	32.9	28.4	26.1	32.3
40	19.5	17	28.2	31.9	100	34.7	32.3	25.8	30.6

(1) Precht and Wittgen, 1881; (2) Etard, 1897; (3) at 25° and at 80°, Soch, 1898.

NOTE. — Page and Keightly, Rudorff and also Nicol give single determinations which lie nearer the results of Precht and Wittgen than to those of Etard.

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AND VICE VERSA.

(Leather and Mukerji, 1913, see also Nicol, 1891.)

Results at 20°.			Results at 40°.			Results at 91°.			
Sp. Gr. Sat. Sol.	Gms. per 100 Gms. H_2O KCl.	NaCl.	Sp. Gr. Sat. Sol.	Gms per 100 Gms. H_2O. KCl	NaCl.	Sp Gr. Sat Sol.	Gms per 100 Gms. H_2O KCl.	NaCl.	Solid Phase in Each Case.
1.176	34.61	0	1.194	40.60	0	1.222	53.58	0	KCl
1.197	26.60	10.13	1.207	31.42	10.68	1.236	45.01	10.66	"
1.213	19.65	20.61	1.235	24.43	20.99	1.262	35.84	22.87	"
1.237	14.92	30.36	1.248	18.23	30.60	1.262	33.12	28.12	"
1.240	15.36	29.61	1.242	18.74	30.32	1.264	32.45	28.26	" +NaCl
1.233	14.76	30.38	1.247	19.13	29.92	1.235	27.15	29.18	NaCl
1.224	9.70	32.40	1.222	10.49	32.59	1.223	13	33.93	"
1.193	0	35.63	1.197	0	36.53	1.189	0	38.72	"

Results are also given for 30°.

100 gms. 40 wt. per cent alcohol dissolve 5.87 gms. KCl + 12.25 gms. NaCl at 25°.
100 gms. 40 wt. per cent alcohol dissolve 5.29 gms. KNO_3 + 10.06 gms. KCl at 25°.

(Soch, 1898.)

100 gms. abs. ethyl alcohol dissolve 0.034 gm. KCl at 18.5°.
100 gms. abs. methyl alcohol dissolve 0.5 gm. KCl at 18.5°.

(de Bruyn, 1892; Rohland, 1898.)

SOLUBILITY DATA FOR THE RECIPROCAL SALT PAIRS $KCl + Na_2SO_4 \rightleftarrows K_2SO_4 + NaCl$.

(Meyerhoffer and Saunders, 1899.)

t°.	d_4 of Sat. Sol.	Mols. per 1000 Mols. H_2O. SO₄.	K₂.	Na₂.	Cl₂.	Solid Phase.
4.4*	...	5.42	14.39	51.83	60.8	$K_3Na(SO_4)_2+KCl+NaCl$
0.2	...	3.35	12.78	50.93	60.36	$Na_2SO_4.10H_2O+KCl+NaCl$
−0.4	...	3.59	16.38	40.75	53.54	$Na_2SO_4.10H_2O+KCl+K_3Na(SO_4)_2$
16	...	4.72	17 58	50.56	63.42	$K_3Na(SO_4)_2+KCl+NaCl$
24.8	1.2484	4.37	20.02	48.36	64.01	"
16.3*	...	16.29	9.16	61.06	53 93	$K_3Na(SO_4)_2+NaCl+Na_2SO_4$ $10H_2O+Na_2SO_4$
24.5	1.2625	14.45	9 90	58.46	53.91	$K_3Na(SO_4)_2+NaCl+Na_2SO_4$
0.3	...	2.75	25 77	17 93	40.95	$K_3Na(SO_4)_2+KCl+K_2SO_4$
25	1.2034	2 94	36.20	14 80	48.06	"
17.9*	1.2470	13 84	0	62.54	48.70	Na_2SO_4 $10H_2O+Na_2SO_4+NaCl$
30.1*	1.289	50.41	10.08	40 33	0	$K_3Na(SO_4)_2+Na_2SO_4$ $10H_2O+Na_2SO_4$

* tr. pt.

Curves are given in the original paper and a complete discussion of the older work.

SOLUBILITY OF MIXTURES OF POTASSIUM CHLORIDE AND POTASSIUM SULFATE IN WATER.

t°.	Gms. per 100 Gms H_2O. KCl	+ K_2SO_4.	Observer.	t°.	Gms. per 100 Gms H_2O. KCl	+ K_2SO_4.	Observer.
10	30.9	1.32	(Precht & Wittgen)	40	38.7	1.68	(P. and W.)
15.8	28	2.3	(Kopp)	50	41.5	1.82	"
20	33.4	1.43	(P and W)	60	43.8	1.94	"
25	34.76	2.93	(Van't Hoff & Meyerhoffer)	80	49.2	2.21	"
30	36.1	1.57	(P. and W)	100	54.5	2.53	"

100 gms. aq. solution, sat. with both salts, contain 26.2 gms. KCl + 1.09 gms. K_2SO_4 at 30°. (Schreinemakers and de Baat, 1914)

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF STANNOUS CHLORIDE AT 25° AND VICE VERSA. (Fujimura, 1914.)

Gms. per 100 Gms. H_2O. $SnCl_2$.	KCl.	Solid Phase.	Gms per 100 Gms H_2O. $SnCl_2$.	KCl.	Solid Phase.
0	34.73	KCl	58.48	17.85	$SnCl_2.KCl.H_2O$
2.86	32.17	"	81.78	19.06	"
4.37	34.08	"	107.65	17.79	"
5.95	31.76	$SnCl_2.2KCl$ $2H_2O$	170.70	21.26	"
5.83	30.65	"	247.50	24.38	"
10.24	27.30	"	337.26	25.51	"
17.42	24.68	"	290.30	19.66	$SnCl_2.2H_2O$
27.88	24.40	"	235.50	7.49	"
34.28	5.99	"	222.5	2.73	"
54.19	19.45	$SnCl_2.KCl$ H_2O	234.05	...	"

SOLUBILITY OF POTASSIUM CHLORIDE IN DILUTE SOLUTIONS OF ETHYL ALCOHOL AT 0° AND AT 25°.

(Armstrong, Eyre, Hussey and Paddison, 1907; Armstrong and Eyre, 1910–11.)

Wt. % C_2H_5OH in Solvent.	Gms. KCl Dissolved per 100 Gms. Sat. Sol at. 0°.	25°.	d_{25} of Sol. Sat.
0	22.1	26.44	1.1813
1.14	21.6	25.91	1.1754
2.25	20.9	25.29	1.1689
4.41	19.7	24.21	1.1568
8.44	...	22.46	1.1357
12.13	15.5	...	...
18.69	...	17.42	1.0847

Solubility of Potassium Chloride in Aqueous Alcohol.

(Gerardin — Ann. chim. phys. [4] 5, 140, '65.)

Interpolated from the original results.

t°.	Grams KCl per 100 Gms. Aq. Alcohol of Sp. Gr.: 0.9904 = 5.5 Wt. %.	0.9848 = 9.35 Wt. %.	0.9793 = 13.6 Wt. %.	0.9726 = 19.1 Wt. %.	0.9573 = 30 Wt. %.	0.939 = 40 Wt. %.	0.8967 = 60 Wt. %.	0.8244 = 90 Wt. %.
0	23.4	19.5	15.5	11.5	7.0	4.0	1.7	0.0
5	25.0	21.0	16.8	12.8	8.0	4.8	2.2	0.0
10	26.4	22.5	18.0	14.0	9.0	5.6	2.7	0.0
15	26.8	24.0	19.2	15.2	10.0	6.4	3.1	0.04
20	29.1	25.3	20.3	16.1	10.8	7.2	3.5	0.06
25	30.4	26.8	21.5	17.1	11.6	7.9	3.9	0.08
30	31.7	28.0	22.6	18.2	12.5	8.5	4.2	0.10
40	34.3	30.8	24.8	20.0	14.0	9.9	4.8	0.20
50	37.0	33.5	27.0	21.8	15.5	10.8	5.2	0.30
60	...	...	...	...	16.8	11.8	5.5	0.40

Solubility of Potassium Chloride in Aqueous Alcohol at:

15°.

(Schiff — Liebig's Ann. 118, 365, '61.)

Sp. Gr. of Alcohol.	Wt. per cent Alcohol.	G. KCl per 100 g. Aq. Alcohol.
0.984	10	19.8
0.972	20	14.7
0 958	30	10.7
0.940	40	7.7
0.918	50	5 0
0.896	60	2.8
0.848	80	0.45

Gerardin's results at 15° agree well with the above determinations.

14.5°.

(Bodländer — Z. physik. Ch. 7, 316, '91.)

Sp. Gr. of Sat. Solutions.	Grams per 100 cc. Solution. C_2H_5OH.	H_2O.	KCl.
1.1720	...	88.10	29.10
1.1542	2.79	85.78	26.85
1.1365	4.98	84.00	24.67
1.1075	10.56	79.63	20.56
1.1085	15.57	75.24	17.24
1.0545	20.66	70.52	14.27
1.0455	24.25	67.05	13.25
0 9695	40.42	50.18	6.35
0.9315	48.73	40.60	3.82
0.8448	68.63	15.55	0.30

30° and 40°.

(Bathrick — J. Physic. Chem. 1, 160, '96.)

Wt. per cent Alcohol.	Gms. KCl per 100 Gms. Aq. Alcohol. At 30°.	At 40°.	Wt. per cent Alcohol.	Gms. KCl per 100 Gms. Aq. Alcohol. At 30°.	At 40°.
0	38.9	41.8	43.1	11.1	13.1
5.28	33.9	35.9	55.9	6.8	8.2
9.43	30.2	33.3	65.9	3.6	4.1
16.9	24.9	27.6	78.1	1.3	1.6
25.1	19.2	21.8	86.2	0.4	0.5
34.1	15.6	17.2			

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 25°.
(McIntosh, 1903.)

Wt. % C_2H_5OH.	Mols. KCl per Liter.	Gms. KCl per 100 cc. Sat. Sol.	Wt. % C_2H_5OH.	Mols. KCl per Liter.	Gms. KCl per 100 cc. Sat. Sol.
0	4.18	31.18	60	0.56	4.18
10	3.21	23.93	70	0.305	2.27
20	2.40	17.89	80	0.125	0.93
30	1.78	13.27	90	0.042	0.31
40	1.26	9.40	100	0.011	0.08
50	0.84	6.26			

SOLUBILITY OF POTASSIUM CHLORIDE IN DILUTE AQUEOUS SOLUTIONS OF METHYL ALCOHOL AT 0° AND AT 25°.
(Armstrong and Eyre, 1910–11.)

Wt. % CH_3OH in Solvent.	Gms. KCl per 100 Gms. Sat. Sol. at: 0°.	25°.
0	22.06	26.69
0.79	21.74	26.42
1.57	21.39	26.01
3.10	20.61	25.25
8.76	17.84	22.82

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS METHYL ALCOHOL AT 25°.
(Herz and Anders, 1907; McIntosh, 1903)

Solvent. d_{25}.	Wt. % CH_3OH.	d_{25} of Sat. Sol.	Gms. KCl per 100 cc. Sat. Sol.	Solvent. d_{25}.	Wt % CH_3OH.	d_{25} of Sat. Sol.	Gms. KCl per 100 cc. Sat. Sol.
0.9971	0	1.1782	31.13	0.8820	64	0.9064	3.44
0.9791	10.6	1.125	24.53	0.8489	78.1	0.8607	1.54
0.9481	30.8	1.033	13.65	0.8167	98.9(?)	0.8242	0.75
0.9180	47.1	0.9679	7.61	0.7882	100	0.7937	0.43

100 gms. methyl alcohol dissolve 0.53 gm. KCl at 25°. (Turner and Bissett, 1913.)
" ethyl " " 0.022 " " " " "
" propyl " " 0.004 " " " " "
" amyl " " 0.0008 " " " " "

Potassium chloride is insoluble in CH_3OH at the crit. temp. (Centnerszwer, 1910.)

SOLUBILITY OF POTASSIUM CHLORIDE IN DILUTE AQUEOUS SOLUTIONS OF PROPYL ALCOHOL AT 0° AND AT 25°.
(Armstrong and Eyre, 1910–11.)

Wt. % C_3H_7OH in Solvent.	Gms. KCl per 100 Gms. Sat. Sol. at: 0°.	25°.
1	22.06	26.44
1.48	21.25	25.94
2.91	20.49	25.23
5.66	18.97	23.82

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF GLUCOSE AT 25°.
(Armstrong and Eyre, 1910–11.)

Wt. % $C_6H_{12}O_6+H_2O$ in Aq. Solvent.	Gms. KCl per 100 Gms. Sat. Solution.
0	26.63
4.72	25.86
9	25.18
16.53	23.89
37.27	20.15

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS ACETONE SOLUTIONS.

(Snell, 1898; at 20°, Herz and Knoch, 1904)

Wt. (see Note) Per cent Acetone in Solvent.	At 20°. KCl per 100 cc. Solution.		At 30°. Gms. per 100 Gms. Solution.		At 40°. Gms. per 100 Gms. Solution.		At 50°. Gms. per 100 Gms. Solution	
	Millimols.	Gms.	Acetone.	KCl.	Acetone.	KCl.	Acetone.	KCl.
0	410.5	30.62	0	27.27	0	28.69	0	30
9.1	351.7	26.23	6.96	23.42	6.79	25.33	...	...
20	286.6	21.38	16.22	18.90	15.75	21.28	...	...
30	223.7	16.69	25.45	15.06	two layers		25.67	14.42
40	166.5	12.42	35.52	11.31	"		36.03	9.93
50	115.4	8.61	45.98	8.04	"		46.46	7.07
60	71.2	5.31	56.91	5.12	"		57.37	4.38
70	38.5	2.87	68.18	2.60	"		68.56	2.22
80	12.9	0.96	79.43	0.76	79.34	0.58	79.25	0.94
90	2	0.15	89.88	0.13	89.84	0.16	±81° sat. sol.	
100	0	0	100	0	100	0		

NOTE. — For the 20° results the per cent acetone in the solvent is in terms of volume instead of weight per cent, and the concentration of the second solution is 10 per cent instead of 9.1 which is the weight per cent concentration of the solvent for the corresponding results at the other temperatures.

AT THE TEMPERATURE 40° AND FOR CONCENTRATIONS OF ACETONE BETWEEN 20 AND 80 PER CENT THE SATURATED SOLUTION SEPARATES INTO TWO LAYERS HAVING THE FOLLOWING COMPOSITIONS:

Upper Layer. Gms. per 100 Gms. Solution.			Lower Layer. Gms. per 100 Gms Solution.		
H_2O.	$(CH_3)_2CO$.	KCl.	H_2O.	$(CH_3)_2CO$.	KCl.
55.2	31.82	12.99	28.14	69.42	2.44
53.27	35.44	11.29	30.96	65.97	3.07
51.23	48.50	10.27	32.64	63.79	3.56
50.34	39.88	9.77	34.07	62.01	3.92
48.02	43.18	8.79	37.44	57.67	4.89
46.49	45.34	8.17	38.68	56.17	5.25
58.99	25.24	15.77	23.66	74.91	1.43

100 cc. sat. solution of potassium chloride in furfurol ($C_4H_3O.COH$) contain 0.085 gm. KCl at 25°. (Walden, 1906.)

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF GLYCEROL AT 25°.
(Herz and Knoch, 1905.)

Sp. Gr. of Glycerol at 25°/4° = 1.2555. Impurity about 1.5%.

Wt. Per cent Glycerol in Solvent.	KCl per 100 cc. Solution. Millimols.	KCl per 100 cc. Solution. Gms.	Sp. Gr. of Solutions.	Wt. Per cent Glycerol in Solvent.	KCl per 100 cc. Solution. Millimols.	KCl per 100 cc. Solution. Gms.	Sp. Gr. of Solutions.
0	424.5	31.66	1.180	54.23	238.5	17.79	1.219
13.28	383.4	28.61	1.185	83.84	149	11.11	1.259
25.98	339.3	25.31	1.194	100	110.6	8.25	1.286
45.36	271.4	20.24	1.211				

100 gms. H_2O dissolve 246.5 gms. sugar + 44.8 gms. KCl at 31.25°, or 100 gms. of the sat. solution contain 62.28 gms. sugar + 11.33 gms. KCl. (Köhler, 1897.)

SOLUBILITY OF POTASSIUM CHLORIDE IN AQUEOUS SOLUTIONS OF PYRIDINE AT 10°.
(Schroeder, 1908.)

Aq. Mixture. cc. H_2O.	Aq. Mixture. cc. Pyridine.	Gms. KCl per 100 Gms. Sat. Sol.	Aq. Mixture. cc. H_2O.	Aq. Mixture. cc. Pyridine.	Gms. KCl per 100 Gms. Sat. Sol.
100	0	23.79	40	60	3.33
90	10	19.76	30	70	1.25
80	20	16.37	20	80	0.24
70	30	13.19	10	90	0.04
60	40	10.05	0	100	0
50	50	6.34			

SOLUBILITY OF POTASSIUM CHLORIDE IN DILUTE AQUEOUS SOLUTIONS OF SEVERAL COMPOUNDS AT 25°.
(Armstrong and Eyre, 1913.)

Compound.	Gms. Cmpd. per 1000 Gms. H_2O.	Gms. KCl per 100 Gms. Sat. Sol.	Compound.	Gms. Cmpd. per 1000 Gms. H_2O.	Gms. KCl per 100 Gms. Sat. Sol.
Water alone	...	26.89	Glycol	15.51	26.43
Acetaldehyde	11.01	27.05	"	62.05	25.26
Paraldehyde	11.01	26.42	Mannitol	45.53	24.86
Glycerol	13.01	25.58	"	136.59	24.46

100 gms. 95% formic acid dissolve 19.4 gms. KCl at 19.7°. (Aschan, 1913.)
" glycerol (d_{15} = 1.256) " 3.72 " " " 15–16°. (Ossendowski, 1907.)
100 cc. anhydrous hydrazine " 9 " " " room temp. (Welsh and Broderson, 1915.)
100 gms. hydroxylamine " 12.3 " " " 17–18°. (de Bruyn, 1892.)

FUSION-POINT DATA (Solubilities, see footnote, p. 1) ARE GIVEN FOR THE FOLLOWING MIXTURES OF POTASSIUM CHLORIDE AND OTHER SALTS.

KCl+KI.	(Wrzesnewski, '12; Amadori & Pampanini, '11; Ruff & Plato, '03.)	$KCl+K_2SO_4$.	(Jaenecke, '12; Sackur, '11–12; Ruff & Plato, '03.)
KCl+KF.	(Ruff and Plato, 1903.)	KCl+HgCl	(Sackur, 1913.)
KCl+KOH.	(Scarpa, 1915.)	KCl+NaCl.	(Sackur, '13; Ruff & Plato, 03.)
$KCl+KCrO_4$.	(Sackur, '11–12; Zemcznzny, '08.)	$KCl+Na_2SO_4$.	(Sackur, 1913.)
$KCl+KPO_3$.	(Amadori, 1912.)	$KCl+SrCl_2$.	(Vortisch, '14; Sackur, '11–12.)
$KCl+K_4P_2O_7$.	"	KCl+TlCl.	(Sandonnini, 1911; 1914.)
$KCl+K_3PO_4$.	"		

POTASSIUM CHLOROIRIDATE K_2IrCl_6.

100 gms. H_2O dissolve 1.25 gms. of the salt at 18–20°.

100 gms. H_2O dissolve 9.18 gms. dipotassium aquopentachloroiridite, $IrCl_5(H_2O)K_2$ at 19°. (Delepine, 1908.)

POTASSIUM CHROMATES K_2CrO_4, $K_2Cr_2O_7$, $K_2Cr_3O_{10}$, etc.

EQUILIBRIUM IN THE SYSTEM, POTASSIUM OXIDE, CHROMIC ACID AND WATER AT SEVERAL TEMPERATURES.

(Koppel and Blumenthal, 1907.)

Results at 0°. Gms. per 100 Gms. Sat. Solution.		Results at 30°. Gms. per 100 Gms. Sat. Solution.		Results at 60°. Gms. per 100 Gms. Sat. Solution.		Solid Phase at each Temp.
K_2O.	CrO_3.	K_2O.	CrO_3.	K_2O.	Cr_2O_3.	
31.18	...	46.8	...	about 50	...	$KOH.2H_2O$
26.06	0.54	26.89	0.94	32.98	0.53	K_2CrO_4
19.31	4.27	22.25	3.06	21.05	9.15	"
17.06	11.77	18.65	13.72	20.25	14.43	"
17.62	18.71	19.12	20.30	20.70	21.97	"
17.73	19.04	19.35	21	20.61	23.61	" $+K_2Cr_2O_7$
10.90	11.93	15.04	16.85	14.53	20.82	$K_2Cr_2O_7$
1.87	3.13	11.20	13.11	10.01	21.21	"
0.78	22.38	2.42	28.21	6.86	39.64	"
1.47	42.95	2.50	44.50	7.06	49.84	" $+K_2Cr_3O_{10}$
1.25	44.52	...	...	4.06	54.73	$K_2Cr_3O_{10}$
1.17	46.84*	...	...	2	60.69	"
1.37	47.40	2.35	49.95	...	...	" $+K_2Cr_4O_{13}$
1.24	48.23	1.35	53.39	...	...	$K_2Cr_4O_{13}$
1.16	56.93	...	...	...	...	"
0.64	61.79	0.69	62.81	1.27	65.77	" $+CrO_3$
0	61.54	...	62.52	0	65.12	CrO_3

THE CRYOHYDRATES (EUTECTICS) IN THE SYSTEM $K_2O - CrO_3 - H_2O$.

The points were determined by adding to a sat. solution of $K_2Cr_2O_7$ successive 1 to 2 gm. portions of chromic acid and ascertaining the freezing-point and composition of the solution. At the point of appearance of a new solid phase an additional amount of chromic acid does not change the f.-pt. since the added CrO_3 goes into the solid phase. This relation also holds at the points where the solution is simultaneously saturated with $K_2Cr_2O_7$ and $K_2Cr_3O_{10}$ or $K_2Cr_3O_{10}$ and $K_2Cr_4O_{13}$.

t° of Equilibrium of Sat Sol. with Ice.	Gms. per 100 Gms. Sat Solution. K_2O.	CrO_3.	Solid Phase in Equilibrium with Sat. Sol. and Ice.	t° of Equilibrium of Sat. Sol. with Ice.	Gms. per 100 Gms Sat Solution K_2O.	CrO_3.	Solid Phase in Equilibrium with Sat. Sol. and Ice.
−25	20	5.70	K_2CrO_4	−13.22	not det.	27.26	$K_2Cr_2O_7$
−13	17.52	13.89	"	−14.50	"	28.85	"
−11.37	17.12	18.18	"	−22.10	"	35.92	"
−11.50	17.18	18.11	" $+K_2Cr_2O_7$	−22.11	0.47	36.14	"
−5	8.27	8.01	$K_2Cr_2O_7$	−26.77	0.88	39.86	"
−0.63	1.38	2.93	"	−30.20	1.18	42.31	" $+K_2Cr_3O_{10}$
−1.78	not det.	6.81	"	−34.01	0.95	43.45	$K_2Cr_3O_{10}$
−5.5	"	16.05	"	−39	0.79	45.65	" $+K_2Cr_4O_{13}$
−6.43	0.48	17.25	"	−49	not det.	49.11	$K_2Cr_4O_{13}$
10.25	0.45	23.63	"	−61.5	0.61	53.57	"

The viscosity of the solutions at the lower temperatures increased so much that the cryohydrate points could not be determined. By graphic extrapolation the cryohydrate temperature of chromic acid and of chromic acid + potassium tetrachromate is near −80° and the CrO_3 content is 59 gms. per 100 gms. sat. solution.

By interpolation from the data given in the preceding tables the following solubilities in water are obtained:

THE ICE CURVE AND SOLUBILITY OF POTASSIUM CHROMATE IN WATER.

t°.	Gms. K_2CrO_4 per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. K_2CrO_4 per 100 Gms. H_2O.	Solid Phase.
− 0.99	4.53	Ice	−11.35 Eutec.	54.54	Ice+K_2CrO_4
− 1.2	6.12	"	0	57.11	K_2CrO_4
− 4.3	26.99	"	30	65.13	"
− 7.12	42.04	"	60	74.60	"
−10.35	52.41	"	105.8 b. pt.	88.8	"

Potassium Dichromate

t°.	Gms. $K_2Cr_2O_7$ per 100 Gms. H_2O.
−0.63*	4.50
0	4.65
30	18.13
60	45.44
104.8†	108.2

Potassium Dichromate + Potassium Chromate.

t°.	Gms. per 100 Gms H_2O. K_2O.	CrO_3.
−11.5*	17.18	18.11
0	17.73	19.03
+30	19.35	21
60	20.61	23.61
106.8†	24.3	30.5

Potassium Dichromate + Potassium Trichromate.

t°.	Gms. per 100 Gms. Sat Solution. K_2O.	CrO_3.
−30*	1.18	42.51
0	1.47	42.99
+20	2.20	43.10
30	2.50	44.50
60	7.06	49.84
114†	16.80	59.20

* Eutec. † b. pt.

Potassium Trichromate + Potassium Tetrachromate.

t°.	Gms per 100 Gms Sat Sol. K_2O.	CrO_3.
−39 Eutec.	0.79	45.69
0	1.37	47.40
20	2	48.46
30	2.25	49.95
60	5.01	54.09

Potassium Tetrachromate + Chromic Acid (CrO_3).

t°.	Gms per 100 Gms. Sat. Sol. K_2O	CrO_3.
0	0.64	61.79
20	0.62	62.80
30	0.69	62.81
60	1.27	65.77

Data for boiling points in the system $K_2O + CrO_3.H_2O$ determined by means of the Beckmann apparatus, are also given.

The older data for K_2CrO_4 and $K_2Cr_2O_7$ are as follows:

SOLUBILITY OF EACH IN WATER.

(Alluard, 1864; Nordenskjold and Lindstrom, 1869; Etard, 1894; Kremers, 1854; Tilden and Shenstone, 1884)

t°.	Potassium Chromate. Grams per 100 Grams Water.			Potassium Dichromate. Grams per 100 Grams Water.	
0	58.2*	59.3†	60.2‡	5*	5§
10	60.0	61.2	62.5	7	7
20	61.7	63.2	64.5	12	12
25	62.5	64.2	64.5	16	16
30	63.4	65.2	66.5	20	20
40	65.2	67.0	68.6	26	27
50	66.8	69.0	70.6	34	37
60	68.6	71.0	72.7	43	47
70	70.4	73.0	74.8	52	58
80	72.1	75.0	76.9	61	70
90	73.9	77.0	79.0	70	82
100	75.6	79.0	82.2	80	97
125	79.0	...	...	110	145
150	83.0	...	...	143	205

* Etard. † Alluard. ‡ N. and L. § A., K., T. and S.

Solubility of Potassium Chromates in Water at 30°.

(Schreinemaker — Z. physik. Ch. 55, 83, '06.)

Composition in Wt. per cent of: The Solution, Per cent CrO_3.	The Solution, Per cent K_2O.	The Residue, Per cent CrO_3.	The Residue, Per cent K_2O.	Solid Phase.
0	±47	...	...	$KOH.2H_2O$
0.0	47.16	12.59	47.54	K_2CrO_4
0.1775	34.602	10.93	37.47	"
1.351	26.602	16.482	32.532	"
5.598	20.584	37.131	39.922	"
15.407	19.225	27.966	29.377	"
20.67	19.17	...	...	$K_2CrO_4 + K_2Cr_2O_7$
19.096	17.30	37.64	22.61	$K_2Cr_2O_7$
11.35	7.88	...	...	"
17.93	3.412	25.85	7.82	"
43.51	3.01	49.45	9.91	"
44.46	3.245	53.94	12.40	$K_2Cr_2O_7 + K_2Cr_3O_{10}$
46.368	2.823	60.314	12.985	$K_2Cr_3O_{10}$
49.357	2.353	63.044	11.684	$K_2Cr_3O_{10} + K_2Cr_4O_{13}$
53.215	1.360	62.958	8.002	$K_2Cr_4O_{13}$
62.55	0.796	67.944	6.731	"
62.997	0.621	70.0	4.0	$K_2Cr_4O_{13} + CrO_3$
62.28	0.0	...	...	CrO_3

100 gms. sat. solution in glycol, $C_2H_4(OH)_2.H_2O$, contain 1.7 gms. K_2CrO_4 at 15.4°.
100 gms. sat. solution in glycol, $C_2H_4(OH)_2.H_2O$, contain 6 gms. $K_2Cr_2O_7$ at 14.6°. (de Coninck, 1905.)

100 gms. H_2O dissolve 10.1 gms. $K_2Cr_2O_7$ at 15.5°. (Greenish and Smith, 1901.)

100 gms. sat. solution in water contain 5.52 gms. $K_2Cr_2O_7$ at 4.81°, 15.17 gms. at 30.1° and 17.77 gms. at 35.33°. (Le Blanc and Schmandt, 1911.)

100 cc. sat. aqueous solution contain 11.43 gms. $K_2Cr_2O_7$ at 20°. (Sherrill and Eaton, 1907.)

Solubility of Potassium Chromate in Aqueous Solutions of Potassium Molybdate at 25° and Vice Versa.

(Amadori, 1912a)

Gms. per 100 Gms H_2O. K_2CrO_4.	K_2MoO_4.	Gms per 100 Gms H_2O. K_2CrO_4	K_2MoO_4	Gms per 100 Gms H_2O K_2CrO_4.	K_2MoO_4.
64.62	0	14.13	98.72	4.92	165.4
49.59	15.37	10.07	118.8	2.14	180.8
38.90	38.79	10.24	119.9	1.70	183
33.21	50.96	7.12	137.8	0	184.6
		6.37	157.2		

Solubility of Potassium Chromate in Aqueous Solutions of Potassium Sulfate at 25° and Vice Versa.

(Amadori, 1912a.)

Gms. per 100 Gms. H_2O. K_2CrO_4.	K_2SO_4.	Gms per 100 Gms H_2O. K_2CrO_4.	K_2SO_4.	Gms. per 100 Gms H_2O. K_2CrO_4.	K_2SO_4.
63.09	0.76	40.93	3.33	7.81	8.98
61.39	1.17	27.36	4.82	4.36	10.25
58.40	1.84	20.83	5.72	1.94	10.86
51.81	2.36	14.65	7.12	0	12.10

100 cc. anhydrous hydrazine dissolve 1 gm. K_2CrO_4 at room temp.
100 cc. anhydrous hydrazine dissolve 1 gm. $K_2Cr_2O_7$ at room temp. (Welsh and Broderson, 1915.)

FREEZING-POINT DATA (Solubilities, see footnote, p. 1) FOR MIXTURES OF POTASSIUM CHROMATES AND OTHER COMPOUNDS.

$K_2CrO_4 + K_2Cr_2O_7$.	(Groschuff, 1908.)
$K_2CrO_4 + K_2MoO_4$.	(Amadori, 1913.)
$K_2Cr_2O_7 + K_2Mo_2O_7$.	"
$K_2CrO_4 + K_2SO_4$.	(Amadori, 1913; Groschuff, 1908.)
$K_2CrO_4 + K_2WO_4$.	(Amadori, 1913.)
$K_2Cr_2O_7 + K_2W_2O_7$.	"

POTASSIUM CITRATE $(CH_2)_2C(OH)(COOK)_3.H_2O$.

SOLUBILITY IN WATER.

(Average results of Seidell, 1910; Greenish and Smith, 1901; Köhler, 1897.)

t°.	Gms. $(CH_2)_2C(OH)(COOK)_3.H_2O$ per 100 Gms. Sat. Solution.	Water.
15	61.8	162
20	63.2	172
25	64.5	182 (d_{25} = 1.518)
30	66	194

100 gms. H_2O dissolve 198.3 gms. $(CH_2)_2COH(COOK)_3$ + 303.9 gms. cane sugar at 31.25°. (Köhler, 1897.)

SOLUBILITY OF POTASSIUM CITRATE IN AQUEOUS ETHYL ALCOHOL AT 25°.

(Seidell, 1910.)

When potassium citrate is added to aqueous alcohol of certain concentrations the mixture separates into two liquid layers. A series of determinations made by adding an excess of the salt to 10–15 cc. portions of several aq. alcohol mixtures at 25° gave the following results.

Wt % C_2H_5OH in Solvent.		d_{25} of Sat. Solution.	Wt. % C_2H_5OH in Sat. Solution.	Gms. $(CH_2)_2COH(COOK)_3.H_2O$ per 100 Gms. Sat. Solution.
8.9	a	...	...	...
	b	1.4920	0	60
32	a	...	...	0.2
	b	1.4930	0	61.6
51	a	...	65.1	0.38
	b	...	...	62.5
70.2	a	0.8366	81	0.10
	b	...	...	62.3
81.4		0.8356	81.4	0.038
91.6		0.8139	91.6	0.016
99.9		0.7896	99.5	0.014

a = upper, alcohol rich layer. *b* = lower, water rich layer.

A series of determinations was also made by adding just enough potassium citrate to the alcohol solution to cause distinct clouding and then, after bringing to 25°, titrating with the aqueous alcohol mixture to disappearance of the clouding. The results were plotted and the following interpolated values obtained.

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Solution.	Gms. $(CH_2)_2COH(COOK)_3.H_2O$ per 100 Gms. Sat. Sol.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Solution.	Gms. $(CH_2)_2COH(COOK)_3.H_2O$ per 100 Gms. Sat. Sol.
0	1.518	64.5	40	1.005	12.4
5	1.400	52.5	50	0.943	5.6
10	1.310	45.5	60	0.900	1.6
20	1.177	31.5	70	0.868	0.4
30	1.085	21.5	80	0.838	0.04

In one determination at 15°, made with alcohol of 59 Vol. per cent, 4.51 gms. $(CH_2)_2COH(COOK)_3.H_2O$ were required to just cause clouding.

POTASSIUM CYANATE KCNO.

SOLUBILITY IN ALCOHOLIC MIXTURES.
(Erdmann, 1893.)

Solvent.	Gms. KCNO per Liter Solvent at b.-pt.
80 per cent Alcohol + 20 per cent Water	62
80 per cent Alcohol + 20 per cent Methyl Alcohol	76
80 per cent Alcohol + 10 per cent Acetone	82

POTASSIUM CYANIDE KCN.

100 gms. H_2O dissolve 122.2 gms. KCN, or 100 gms. sat. solution contain 55 gms. KCN at 103.3°. (Griffiths.)

100 gms. abs. ethyl alcohol dissolve 0.87 gm. KCN at 19.5°.

100 gms. abs. methyl alcohol dissolve 4.91 gms. KCN at 19.5°. (de Bruyn, 1892.)

100 gms. glycerol dissolve 32 gms. KCN at 15.5°. (Ossendowski, 1907.)

100 gms. hydroxylamine dissolve 41 gms. KCN at 17.5°. (de Bruyn, 1892.)

F.-pt. data for KCN + KCl, KCN + NaCN, KCN + AgCN, KCN + $Cu_2(CN)_2$ and for KCN + $Zn(CN)_2$ are given by Truthe (1912).

POTASSIUM CHROMOCYANIDE $K_3Cr(CN)_6$.

100 gms. H_2O dissolve 32.33 gms. $K_3Cr(CN)_6$ at 20°. (Moissan, 1885; Christensen, 1885.)

POTASSIUM CHROMITHIOCYANATE $K_2Cr(SCN)_6.4H_2O$.

100 gms. H_2O dissolve 139 gms. salt. (Karsten, 1864-5.)

POTASSIUM CARBONYL FERROCYANIDE $K_3FeCO(CN)_5.3\frac{1}{2}H_2O$.

100 gms. H_2O dissolve 148 gms. salt at 16°. (Müller, 1887.)

POTASSIUM FERRICYANIDE $K_3Fe(CN)_6$.

POTASSIUM FERROCYANIDE $K_4Fe(CN)_6.3H_2O$.

SOLUBILITY OF EACH IN WATER.
(Wallace, 1855; Etard, 1894; Schiff, 1860, Michel and Krafft, 1858; Thomsen.)

NOTE. — The available determinations fall very irregularly when plotted on cross-section paper, and the following figures, which are averages, are therefore hardly more than rough approximations to the true amounts. The figures under $K_4Fe(CN)_6$ show the limits between which the correct values probably lie.

t°.	Gms per 100 Gms H_2O. $K_3Fe(CN)_6$.	$K_4Fe(CN)_6$		t°.	Gms. per 100 Gms. H_2O. $K_3Fe(CN)_6$.	$K_4Fe(CN)_6$.	
0	31	13	...	40	60	38	70
10	36	20	20	60	66	52	83
20	43	25	40	80	...	66	89
25	46	28	48	100	...	76	91
30	50	32	57	104.4	82.6	...	...

100 gms. H_2O dissolve 0.08946 gm. mols. = 32.97 gms. $K_4Fe(CN)_6$ at 25°, d_{25} of sat. sol. = 1.0908. (Harkins and Pearce, 1916.)

One liter of sat. solution in water contains 319.4 gms. $K_4Fe(CN)_6.3H_2O$ at 25°. (Grube, 1914.)

Using the Harkins and Pearce figure for d_{25}, this result corresponds to 34.3 gms. $K_4Fe(CN)_6$ per 100 gms. H_2O.

One liter of sat. solution in water contains 385.5 gms. $K_3Fe(CN)_6$ at 25°. (Grube, 1916.)

One liter sat. sol. in 0.4687 *n* KOH contains 342.7 gms. $K_3Fe(CN)_6$ at 25°. (Grube, 1914.)
" " 0.9628 " " 302.3 " " " "
" " 1.949 " " 215.1 " " " "

100 cc. anhy. hydrazine dissolve 2 gms. $K_3Fe(CN)_6$ at room temp. (Welsh and Broderson, 1915.)

SOLUBILITY OF POTASSIUM FERROCYANIDE IN AQ. POTASSIUM HYDROXIDE SOLUTIONS AT 25°. (Grube, 1914.)

Solvent.	Gms. $K_4Fe(CN)_6.3H_2O$ per 1000 cc. Sat Sol.	Solid Phase.	Solvent.	Gms. $K_4Fe(CN)_6.3H_2O$ per 1000 cc. Sat. Sol.	Solid Phase.
0.09984 *n* KOH	308.5	$K_4Fe(CN)_6.3H_2O$	0.9415 *n* KOH	184.8	$K_4Fe(CN)_6.3H_2O$
0.2496 "	283.5	"	1.395 "	132.1	"
0.4963 "	247.1	"	1.883 "	86.12	"
0.7036 "	217.4	"			

SOLUBILITY OF MIXTURES OF POTASSIUM FERROCYANIDE AND FERRICYANIDE IN WATER AND IN AQ. POTASSIUM HYDROXIDE SOLUTIONS AT 25°. (Grube, 1914.)

Solvent.	Gms per 1000 cc. Sat Solution.		Solid Phase.
	$K_3Fe(CN)_6$.	$K_4Fe(CN)_6$.	
Water	338.1	79.02	$K_3Fe(CN)_6+K_4Fe(CN)_6.3H_2O$
0.4687 *n* KOH	309	66.64	" "
0.9628 "	275.3	55.19	" "
1.949 "	200.8	35.95	" "

SOLUBILITY OF POTASSIUM FERROCYANIDE IN AQUEOUS SOLUTIONS OF SODIUM FERROCYANIDE AT 25° AND VICE VERSA. (Harkins and Pearce, 1916.)

Mols per 1000 Gms H_2O.		Gms $K_4Fe(CN)_6$ per 1000 Gms. H_2O.	$d_{\frac{25}{4}}$ of Sat Sol.	Mols per 1000 Gms H_2O		Gms. $Na_4Fe(CN)_6$ per 1000 Gms. H_2O.	$d_{\frac{25}{4}}$ of Sat. Sol.
$Na_4Fe(CN)_6$.	$K_4Fe(CN)_6$.			$K_4Fe(CN)_6$	$Na_4Fe(CN)_6$.		
0	0.89459	329.5	1.09081	0	0.6818	205.25	1.0595
0.05072	0.88272	325.1	1.0990	0.1327	0.7056	214.47	1.0199
0.06633	0.88544	326	1.10039	0.1789	0.7213	219.23	1.0792
0.12306	0.88088	324.4	1.09350	0.2115	0.7253	220.44	1.1006
0.25972	0.89116	328.3	1.12796	0.2722	0.7610	231.29	1.1113
0.4900	0.91600	337.4	1.17241	0.3532	0.7814	237.49	1.1243
0.87034	0.99000	364.6	1.19700	0.5850	0.8652	262.97	1.1567
0.91060	1.01200	372.3	1.21190	0.6111	0.8712	264.79	1.1581
0.95879	1.05177	387.5	1.22673	0.6994	0.8984	273.05	1.1830
1.0438	1.1159	411	1.25789	1.0578	0.9588	291.40	1.2267

POTASSIUM ZINC CYANIDE $K_2Zn(CN)_4$.

100 cc. H_2O dissolve 11 gms. $K_2Zn(CN)_4$ at 20°. (Sharwood, 1903.)

POTASSIUM FLUORIDE $KF.2H_2O$.

100 gms. H_2O dissolve 92.3 gms. KF, or 100 gms. sat. solution contain 48 gms. KF at 18°. Sp. Gr. of solution = 1.502. (Mylius and Funk, 1897.)

SOLUBILITY OF POTASSIUM FLUORIDE IN HYDROFLUORIC ACID AT 21°. (Ditte, 1896.)

Gms. per 100 Gms. H_2O.		Gms. per 100 Gms. H_2O.		Gms. per 100 Gms. H_2O.	
HF.	KF.	HF.	KF.	HF.	KF.
0.0	96.3	9.25	29.9	20.68	38.4
1.21	72.0	11.36	29.6	28.60	46.9
1.61	61.0	12.50	30.5	41.98	61.8
3.73	40.4	13.95	31.4	53.71	74.8
4.03	32.5	15.98	33.4	74.20	105.0
6.05	30.4	17.69	35.62	119.20	169.5

According to de Forcrand (1911), a saturated solution of $KF.2H_2O$ in water at 18° has the composition 1 mol. KF + 3.90 mols. H_2O = 45.3 gms. per 100 gms. sat. solution. The solution in contact with $KF.4H_2O$ as solid phase, has the composition 1 mol. KF + 5.76 mols. H_2O = 35.96 gms. KF per 100 gms. sat. solution.

EQUILIBRIUM IN THE SYSTEM POTASSIUM FLUORIDE, ETHYL ALCOHOL AND WATER AT 23°–26°.

(Frankforter and Frary, 1913.)

The authors determined the binodal curve, the quadruple points and two tie lines.

Gms. per 100 Gms. Upper Layer.			Gms. per 100 Gms. Lower Layer.		
KF.	C_2H_5OH.	H_2O	KF.	C_2H_5OH.	H_2O.
1.23	92 67	6 07*	45.33	0 67	54*
...	...	...	37.82	1 70	60 49
1.16	83 30	15.54	...	...	...
...	...	...	28.68	4 47	66.85
2.86	65.81	31 33	...	. .	...
4.47	57 4	38 13	20 90	11.9	67.2†
5.47	53.04	41 49	..	..	...
...	...	. .	18.55	15.6	65 85
6.93	47.52	45 55	...	...	.
8.84	41.28	49 88	15 7	21.8	62 5†
9 55	38.66	51 79	...	...	...
...	...	. .	13 57	27 27	59 15
10.52	35.91	53 57	...	...	..
...	...	. .	11.43	33 23	54 34
11	30	59	11	30	59‡

* Quad. points. † Tie line. ‡ Plait point approx.

A method for the determination of alcohol in unknown mixtures, based upon the above data, is described by the authors.

THE BINODAL CURVE FOR THE SYSTEM POTASSIUM FLUORIDE, PROPYL ALCOHOL AND WATER AT 23°–26°.

(Frankforter and Frary, 1913)

Gms. per 100 Gms. Homogeneous Liquid			Gms per 100 Gms Homogeneous Liquid.		
KF.	C_3H_7OH	H_2O	KF.	C_3H_7OH.	H_2O.
0.17	96.78	3 05*	8 15	7 49	84.36
0.31	78.91	21.19	10	5 97	84 03
0.62	66 29	33 09	12 21	4 39	83.41
0.81	59 97	39 22	14.18	3 45	82.37
1.29	47.46	51 21	18 75	1 89	79 35
1.77	35 40	62 83	25 83	0 74	73 43
2.50	19 05	78 45	35 38	0 23	64 38
5.32	10.64	84 04	47 62	0.039	52.34*

* Quad. point.

One tie line was determined. In this case the upper layer contained 78.91% C_3H_7OH and 0.31% KF, and the lower layer contained 9.67% KF.

In this system, the effect of change in temperature is more marked than in the preceding one in which ethyl alcohol is present.

100 gms. sat. solution of potassium fluoride in 99.6% propyl alcohol contain 0.34 gm. KF at room temp. (Frankforter and Frary, 1913.)

BINODAL CURVE FOR THE SYSTEM POTASSIUM FLUORIDE, ISOPROPYL ALCOHOL AND WATER AT 20°.

(Frankforter and Temple, 1915.)

Results in terms of gms. per 100 gms. of solvent, alcohol + water.

Gms. per 100 Gms. Solvent.			Gms. per 100 Gms. Solvent.		
KF.	$CH_3CHOHCH_3$.	H_2O.	KF.	$CH_3CHOHCH_3$.	H_2O.
51.826	1.555	98.445	12.385	21.438	78.562
38.748	2.965	97.035	5.071	59 339	40.661
26.039	6.525	93.475	3.973	65 455	34.545
17.812	12.215	87.785	1.705	82.750	17.250

BINODAL CURVE FOR THE SYSTEM POTASSIUM FLUORIDE, ALLYL ALCOHOL AND WATER AT 20°.

(Frankforter and Temple, 1915.)

The results are given in terms of grams per 100 gms. Alcohol + Water instead of gms. per 100 gms. of the homogeneous mixture.

Gms. per 100 Gms. Solvent.			Gms. per 100 Gms. Solvent.		
KF.	$CH_2:CH.CH_2OH$.	H_2O.	KF.	$CH_2:CHCH_2OH$.	H_2O.
45.707	2.270	97.730	7.508	35.390	64.610
38.076	3.983	96.017	6.024	42.011	57.989
30.675	5.879	94.121	4.813	47.550	52.450
24.341	7.129	92.871	3.631	54.211	45.789
20.580	9.691	90.309	2.236	59.948	36.443
17.371	11.491	88.509	1.931	65.630	34.370
13.184	17.764	82.236	1.635	68.845	31.155
10.880	22.537	77.463	1.368	71.395	28.605
8.873	29.529	70.471	1.066	75.377	24.223

BINODAL CURVE FOR THE SYSTEM POTASSIUM FLUORIDE, ACETONE, WATER AT 20°.

(Frankforter and Cohen, 1914.)

Gms. per 100 Gms. Homogeneous Mixture.			Gms. per 100 Gms. Homogeneous Mixture.		
KF.	$(CH_3)_2CO$.	H_2O.	KF.	$(CH_3)_2CO$.	H_2O.
46.3	trace	53.7*	9.17	23.53	67.30
44.24	0.24	55.52	5	38.72	56.28
33.34	1	65.66	3.06	47.89	46.84
29.86	1.60	68.54	1.38	58.06	40.55
25.74	3.02	71.24	0.979	62.60	36.42
20.28	5.90	73.80	0.75	65.41	33.84
16.31	9.72	73.97	0.50	69.58	29.92
12.40	15.59	72.01	0	98	2*

* Quad. point.

Data for 4 tie lines are also given and the approximate position of the plait point is shown on the diagram.

Several points on the binodal curves at temperatures between 0° and 35° are also given.

A discussion, with examples, is given of the applicability of the above data to the determination of acetone in unknown mixtures.

BINODAL CURVE FOR THE SYSTEM POTASSIUM FLUORIDE, METHYL ETHYL KETONE AND WATER AT 20°.

(Frankforter and Cohen, 1916.)

Gms. per 100 Gms. Homogeneous Mixture.			Gms. per 100 Gms. Homogeneous Mixture.		
KF.	$CH_3.CO.C_2H_5$.	H_2O.	KF.	$CH_3.CO.C_2H_5$.	H_2O.
34.38	0.17	65.45	10.50	4.87	84.63
23.63	0.50	75.87	5.70	9.93	84.37
18.62	1.49	79.89	3.96	12.42	83.61
15.91	2.19	81.90	0.84	21.23	77.93
13.80	2.98	83.22	0.34	23.55	76.11

Freezing-point data (solubilities, see footnote, p. 1) for mixtures of KF + KI are given by Ruff and Plato (1903). Results for KF + KOH by Scarpa (1915). Results for KF + KPO_3, KF + $K_4P_2O_7$ and KF + K_3PO_4 are given by Amadori (1912). Results for KF + K_2SO_4 are given by Karandeef (1909). Results for KF + NaF are given by Kurnakow and Zemcznzny (1907).

POTASSIUM FORMATE HCOOK.

SOLUBILITY OF POTASSIUM FORMATE AND OF THE ACID SALT IN WATER.
(Groschuff, 1903.)

Solid Phase : HCOOK.

t°.	Gms. HCOOK per 100 Gms. Solution.	Mols. HCOOK per 100 Mols. H_2O.
− 20	72.8	57.4
+ 18	76.8	71.0
50	80.7	89.8
90	86.8	141.0
120	92.0	247.0
140	96.0	511
157	100.0	∞

Solid Phase : HCOOK.HCOOH.

t°.	Gms. HCOOK.HCOOH per 100 Gms. Solution.	Gms. HCOOK per 100 Gms. Solution.	t°.	Gms. HCOOK per 100 Gms. Solution.	Mols. HCOOH per 1 Mol. HCOOK.
0	60.4	39.0	0	36.3	3.21
25	69.8	45.1	19.5	38.2	2.96
50	79.2	51.2	39.3	40.8	2.65
80	90.7	58.6	60	44.0	2.33
			70	45.9	2.16
			90	52.1	1.68

Sp. Gr. of sat. solution at 18° = 1.573.

NOTE. — Since the acid salt is less soluble at ordinary temperatures than the neutral salt, it can be precipitated from the solution of the neutral salt by addition of aqueous formic acid. Proceeding in this way an impure product is obtained, giving solubility values (expressed in HCOOK) as shown in the last three columns above.

POTASSIUM GERMANIUM FLUORIDE K_2GeF_6.

SOLUBILITY IN WATER.
(Winkler, 1887; Kruss and Nilson, 1887.)

100 gms. H_2O dissolve 173.98 gms. K_2GeF_6 at 18°, and 34.07 gms. at 100° (W.).
100 gms. H_2O dissolve 184.61 gms. K_2GeF_6 at 18°, and 38.76 gms. at 100° (K. and N.).

POTASSIUM HYDROXIDE KOH.

SOLUBILITY IN WATER.
(Pickering, 1893; at 15°, Ferchland, 1902.)

t°.	Gms. KOH per 100 Gms. Water.	Gms. KOH per 100 Gms. Solution.	Solid Phase.	t°.	Gms. KOH per 100 Gms. Water.	Gms. KOH per 100 Gms. Solution.	Solid Phase.
− 2.2	3.7	3.6	Ice	15	107	51.7	$KOH.2H_2O$
−20.7	22.5	18.4	"	20	112	52.8	"
−65.2	44.5	30.8	"	30	126	55.76	"
−36.2	36.2	26.6	$KOH.4H_2O$	32.5	135	57.44	$KOH.2H_2O+KOH.H_2O$
−32.7	77.94	43.8	"	50	140	58.33	$KOH.H_2O$
−33	80	44.4	$KOH.4H_2O+KOH.2H_2O$	100	178	64.03	$KOH.H_2O$
−23.2	85	45.9	$KOH.2H_2O$	125	213	68.06	"
0	97	49.2	"	143	311.7	75.73	"
10	103	50.7	"				

Sp. Gr. of sat. solution at 15° = 1.5355.

100 gms. sat. solution in H_2O contain 50.48 gms. KOH at 15°. (de Forcrand, 1909.)

100 gms. sat. solution in H_2O contain 53.1 gms. KOH at 15°. (Greenish and Smith, 1901.)

SOLUBILITY OF POTASSIUM HYDROXIDE IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL AT 30°. (deWaal, 1910.)

Gms. per 100 Gms. Sat. Sol.			Solid Phase.	Gms. per 100 Gms. Sat. Sol.			Solid Phase.
KOH.	C_2H_5OH.	H_2O.		KOH.	C_2H_5OH.	H_2O.	
55.75	0	44.25	$KOH.2H_2O$	27.67	69.92	2.41	$KOH.2H_2O$
54.81	0.43	44.76	"	27.20	73.01	negative*	"
Two liquid layers are formed here.				26.25	81.95	"	"
31	57.50	11.50	$KOH.2H_2O$				
28.99	65.07	5.94	"				

* Negative on account of reaction $KOH + C_2H_5OH \rightarrow C_2H_5OK + H_2O$.

Data for equilibrium in the system potassium hydroxide, phenol, water at 25° are given by van Meurs (1916).

Freezing-point data for KOH + RbOH and KOH + NaOH are given by von Hevesy (1900). Results for KOH + KI are given by Scarpa (1915).

POTASSIUM IODATE KIO_3.

SOLUBILITY IN WATER.
(Kremers, 1856a; at 30°, Meerburg, 1904.)

t°.	0°	20°	30°	40°	60°	80°	100°
Gms. KIO_3 per 100 gms. H_2O	4.73	8.13	11.73	12.8	18.5	24.8	32.2

100 gms. H_2O dissolve 1.3 gms. potassium hydrogen iodate, $KH(IO_3)_2$, at 15°, and 5.4 gms. at 17°. (Serullas.)

100 gms. H_2O dissolve 4 gms. potassium dihydrogen iodate, $KH_2(IO_3)_3$, at 15°. (Meineke, 1891.)

EQUILIBRIUM IN THE SYSTEM POTASSIUM IODATE, IODIC ACID, WATER AT 30°. (Meerburg, 1905.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
HIO_3.	KIO_3.		HIO_3	KIO_3	
0	9.51	KIO_3	3.47	3.59	$KIO_3.2HIO_3$ (unstable)
0.65	9.49	" $+KIO_3.HIO_3$	4.80	2.90	" "
0.65	8.90	$KIO_3.HIO_3$	6.45	1.35	" "
0.67	6.6	"	9.35	0.64	$KIO_3.2HIO_3$
1.14	4.57	"	12.04	0.44	"
1.69	3.63	"	17.50	0.30	"
2.02	3.10	"	31.20	0.52	"
3.34	2.10	"	53.64	0.68	"
5	1.32	"	62.52	0.72	"
7.09	1	"	76.40	0.80	$+HIO_3$
8.04	0.85	" $+KIO_3.2HIO_3$	76.7	0	HIO_3

100 cc. anhydrous Hydrazine dissolve 1 gm. KIO_3 at room temp. (Welsh and Broderson, 1915.)

POTASSIUM PerIODATE KIO_4.

100 gms. H_2O dissolve 0.66 gm. KIO_4 at 13°, d_{13} of sat. solution = 1.0051. (Barker, 1908.)

POTASSIUM IODIDE

SOLUBILITY IN WATER, DETERMINED BY THE FREEZING-POINT METHOD. (Kremann and Kershbaum, 1907.)

t°.	Gms. KI per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. KI per 100 Gms. Sat. Sol.	Solid Phase.
−12.5	38	Ice	−22.5	52.1	KI
−15	41.2	"	−20	52.6	"
−17.5	44.6	"	−15	53.5	"
−20	48	"	−10	54.5	"
−22.5	51.2	"	−5	55.4	"
−23.2 Eutec.	51.9	" +KI	0	56.4	"

POTASSIUM IODIDE KI.

Solubility in Water.

(Mulder; de Coppet, 1883; Etard, 1894; Meusser, 1905; see also Tilden and Shenstone, 1884; Schreinemakers, 1892.)

t°.	Gms. KI per 100 Gms. Water.	Gms. KI per 100 Gms. Solution.	t°.	Gms. KI per 100 Gms. Water.	Gms. KI per 100 Gms. Solution.
−10	115.1	53.5	80	192	65.8
−5	119.8	54.5	90	200	66.7
−1	122.2	55.0	100	208	67.5
0	127.5	56.0	110	215	68.3
10	136	57.6	120	223	69.0
20	144	59.0		Ice Curve	
25	148	59.7			
30	152	60.3	−5	25.7	22.5
40	160	61.5	−7	42.6	29.9
50	168	62.7	−9.5	51.5	34.0
60	176	63.7	−11.5	64.7	39.3
70	184	64.8	−14	75.8	42.7

Sp. Gr. of sat. solution at 15.2° = 1.704. (Greenish and Smith, 1901.)

Individual determinations, in good agreement with the above results, are given by van Dam and Donk (1911), and by Greenish and Smith (1901).

Solubility of Potassium Iodide + Iodine in Water at 25°.

(Foote and Chalker, 1908)

Gms. per 100 Gms. Sat. Sol. KI.	I.	I − KI.	Present in Solid Phase.	Gms. per 100 Gms. Sat. Sol. KI.	I.	I − KI.	Present in Solid Phase.
29.45	64.34	34.89	KI and KI_3	25.88	68.79	42.91	KI_7 and Iodine
28.91	63.88	34.97	KI and KI_3	25.57	69.01	43.44	KI_7 and Iodine
26.84	66.54	39.70	KI_3 and KI_7	27.86	66.56		KI_3
27.18	67.14	39.96	KI_3 and KI_7	27.27	66.91		KI_3
27.14	66.60	39.46	KI_3 and KI_7	26.95	67.17		KI_7
				25.71	67.91		KI_7

The experiments of Hamberger (1906) are discussed. (See also p. 326.)

Solubility of Mixtures of Potassium Iodide and Silver Iodide in Water at 0°, 30° and 50°.

(Van Dam and Donk, 1911)

Results at 0°. Gms. per 100 Gms. Sat. Sol. AgI.	KI.	Results at 30°. Gms. per 100 Gms. Sat. Sol. AgI.	KI.	Results at 50°. Gms. per 100 Gms. Sat. Sol. AgI.	KI.	Solid Phase in Each Case.
0	56.1	0	60.35	0	62.6	KI
9	53	16	55.5	10.7	59.1	"
18	51.2	35.8	46.9	22.8	55.5	"
31.3	46.6	42.8	43.9	45	43.2	"
37.9	44	44.1	43.2	53.4	37.6	" +AgI.KI
37.6	42.7	47.7	40.9	53.5	37.1	AgI.KI
38	41.3	49.7	38.6	53.5	36.6	" +AgI
28.1	36.4	42.8	38.8	53.5	36.5	AgI
26.6	34.6	29.4	37.6	39	38.1	"
6.5	26.1	10	31.4	28	36.7	"
1.5	20.5	...	..	16	33.8	"
0.2	9.8	0.1	10.2	2.5	24.8	"
27.5	48.7	...	...	...	...	AgI.2KI+KI
21	50.3	...	...	...	...	AgI.2KI

Solubility of Potassium Iodide in Dilute Aqueous Solutions of Ethyl Alcohol at 25°.

(Armstrong, Eyre, Hussey, and Paddison, 1907.)

Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. KI per 100 Gms. Sat. Sol.	Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. KI per 100 Gms. Sat. Sol.
0	1.7268	59.80	4.41	1.6833	58.08
1.14	1.7154	59.41	12.14	1.6063	54.93
2.25	1.7042	58.95	18.73	1.5420	52.08

100 gms. aqueous 94% ethyl alcohol dissolve 3.99 gms. KI at 17°. (de Bruyn, 1892.)
100 gms. aqueous 98% methyl alcohol dissolve 17.1 gms. KI at 17°. "
100 cc. of ethyl alcohol of d_{15} = 0.8292 dissolve 8.83 gms. KI at 15°, d_{15} of sat. solution = 0.8989. (Greenish and Smith, 1901.)

Solubility of Potassium Iodide in Absolute Alcohols.

(de Bruyn — Z. physik. Ch. 10, 783, '92; Rohland — Z. anorg. Ch. 18, 327, '98.)

100 gms. methyl alcohol dissolve 16.5 gms. KI at 20.5°.
100 gms. ethyl alcohol dissolve 1.75 gms. KI at 20.5°.
100 gms. propyl alcohol dissolve 0.46 gm. KI at 15°–20° (R.).

Solubility of Potassium Iodide in:

Ethyl Alcohol of 0.9496 Sp. Gr.		Aqueous Ethyl Alcohol at 18°.					
t°.	Gms. KI per 100 Gms. Alcohol	Sp. Gr. of Alcohol.	Weight per cent Alcohol.	Gms. KI per 100 Gms. Alcohol.	Sp. Gr. of Alcohol.	Weight per cent Alcohol.	Gms. KI per 100 Gms Alcohol.
8	67.4	0.9904	5.2	130.5	0.9390	45	66.4
13	69.2	0.9851	9.8	119.4	0.9088	59	48.2
25	75.1	0.9726	23.0	100.1	0.8464	86	11.4
46	84.7	0.9665	29.0	89.9	0.8322	91	6.2
55	87.5	0.9528	38.0	76.9			
62	90.2						

(Gerardin — Ann. chim. phys. [4] 5, 155, '65.)

Solubility of Potassium Iodide in Aqueous Solutions of Methyl Alcohol at 25°.

(Herz and Anders, 1907.)

Solvent.		Sat. Solution.		Solvent.		Sat. Solution.	
d_{25}.	Wt. Per cent CH_3OH.	d_{25}.	Gms. KI per 100 cc.	d_{25}.	Wt. Per cent CH_3OH.	d_{25}.	Gms. KI per 100 cc.
0.9971	0	1.7213	102.9	0.8820	64	1.185	40.33
0.9791	10.6	1.634	92.12	0.8489	78.1	1.066	28.05
0.9481	30.8	1.460	71.55	0.8167	93.9	0.9700	18.76
0.9180	47.1	1.325	55.6	0.7881	100	0.9018	13.28

Solubility of Potassium Iodide in Several Alcohols.

Alcohol.	t°.	Gms. KI per 100 Gms. Alcohol.	Authority.
Methyl Alcohol	11.4	13.5	(Timofeiew, 1894.)
" "	12.2	14.6	"
" "	13.5	16	"
" "	25	18.04	(Turner and Bissett, 1913.)
Ethyl "	13.6	1.63	(Timofeiew, 1894.)
" "	25	2.16	(Turner and Bissett, 1913.)
Propyl "	12.2	0.731	(Timofeiew, 1894.)
" "	25	0.43	(Turner and Bissett, 1913.)
Amyl "	25	0.098	" "

100 cc. sat. solution of KI in ethyl alcohol contain 1.585 gms. KI at 25°. (Laurie, 1912.)

Solubility of Potassium Iodide in Liquid Methyl Alcohol at Temperatures up to the Critical Point.

(Tyrer, 1910.)

(Determined by the Sealed Tube Method.)

t°.	Gms. KI per 100 Gms. CH_3OH.	t°.	Gms. KI per 100 Gms. CH_3OH.	t°.	Gms. KI per 100 Gms. CH_3OH.
15	14.50	120	27.2	220	27.5
30	16.20	140	29.2	240	24.8
50	18.9	160	30.6	245	22.6
80	22.5	180	30.7	247	21
100	25	200	29.1	250	13.8
				crit. temp. 252.5	7.6

Solubility of Potassium Iodide in Vapor of Methyl Alcohol Above the Critical Point.

(Tyrer, 1910a.)

Solvent, Gms. CH_3OH per 1 cc. Vapor.	Gms. KI Dissolved per 100 Gms. Solvent at: 252°.	270°.	280°.	290°.	300°.
0.1	0.3	...	...	...	...
0.2	1	1	1	1	1
0.3	3.7	3.5	3.4	3.4	3.3
0.36	7.6	7.4	7.3	7.2	7
0.4	11.8	11.5	11.3	11	...
0.45	18.1	...	...	...	...

Data for the above system are also given by Centnerszwer (1910). This author gives the crit. temp. as 266° and the corresponding concentration as 8.64 gms. KI per 100 gms. of the sat. solution.

Solubility of Potassium Iodide in Mixtures of Alcohols at 25°.

(Herz and Kuhn, 1908.)

In Methyl + Ethyl Alcohol. Per cent CH_3OH in Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. KI per 100 cc. Sat. Sol.	In Methyl + Propyl Alcohol. Per cent C_3H_7OH in Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms. KI per 100 cc. Sat. Sol.	In Ethyl + Propyl Alcohol. Per cent C_3H_7OH in Solvent.	$d_{\frac{25}{4}}$ of Sat. Sol.	Gms KI per 100 cc. Sat. Sol.
0	0.8015	1.55	0	0.9018	13.16	0	0.8015	1.55
4.37	0.8041	1.91	11.11	0.8823	10.96	8.1	0.7983	1.46
10.4	0.8071	2.25	23 8	0.86?9	8.54	17.85	0.7991	1.37
41.02	0.8295	4.94	65.2	0 8187	2.62	56.6	0.7988	0.75
80.69	0.8794	10.13	91.8	0.8045	0.60	88.6	0.8022	0.52
84.77	0.8795	10.72	96.6	0.8041	0.58	91.2	0.8027	0.49
91.25	0.8908	11.84	100	0.8041	0.43	95.2	0.8029	0.44
100	0.9018	13.16				100	0.8041	0.43

Solubility of Potassium Iodide in Acetamide.

(Menschutkin, 1908.)

(Determinations by Synthetic Method.)

t°.	Gms. KI per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. KI per 100 Gms. Sat. Sol.	Solid Phase
82 m. pt.	0	CH_3CONH_2	70	28.75	KI
78	6.5	"	85	29.1	"
74	12.8	"	100	29.45	"
70	17.8	"	130	30.15	"
66	21.5	"	145	30.5	"
58	26.2	"	160	30.8	"
53 Eutec.	28.4	" +KI	175	31.1	"

SOLUBILITY OF POTASSIUM IODIDE IN ACETONE AND IN PYRIDINE.

(von Laszcynski, 1894; at 25°, Krug and McElroy, 1892.)

Solvent.	Gms. KI per 100 Gms. Solvent at:					
	−2.5°	10°	22°	25°	56°	119°
Acetone	3.08	...	2.38	2.93	1.21	...
Pyridine	...	0.26	...	...	...	0.11

100 gms. glycerol dissolve 40 gms. KI at 15.5°. (Ossendowski, 1907.)

100 gms. 95% formic acid dissolve 38.2 gms. KI at 18.5°. (Aschan, 1913.)

100 cc. anhydrous hydrazine dissolve 175 gms. KI at room temp. (Welsh and Broderson, 1915.)

100 gms. hydroxylamine dissolve 110 gms. KI at 17.5°. (de Bruyn, 1892.)

100 gms. sat. solution in hydrated lanolin (containing 30% emulsified water) contain 42.5 gms. KI at 45°. (Klose, 1907.) KI is insoluble in anhydrous lanolin.

SOLUBILITY OF POTASSIUM IODIDE IN SEVERAL SOLVENTS.

(Walden, 1906)

Solvent.	Formula.	t°.	Sp. Gr. of Solution.	Gms KI per 100 cc. Solution.	Gms KI per 100 Gms. Solution.
Water	H_2O	0	1.6699	94.05	56.32
Water	H_2O	25	1.7254	102.70	59.54
Methyl Alcohol	CH_3OH	0	0.8964	11.61	12.95
Methyl Alcohol	CH_3OH	25	0.9003	13.5–14.3	14.97
Ethyl Alcohol	C_2H_5OH	0	0.8085	1.197	1.479
Ethyl Alcohol	C_2H_5OH	25	0.7908	1.520	1.922
Glycol	$(CH_2OH)_2$	0	1.3954	45.85	31.03
Glycol	$(CH_2OH)_2$	25	1.3888	47.23	33.01
Acetonitrile	CH_3CN	0	0.8198	1.852	2.259
Acetonitrile	CH_3CN	24	0.7938	1.57	2.003
Propionitrile	C_2H_5CN	0	0.8005	0.34–0.41	0.0429
Propionitrile	C_2H_5CN	25	0.7821	0.32–0.36	0.0404
Benzonitrile	C_6H_5CN	25	1.0076	0.051	0.0506
Nitromethane	CH_3NO_2	0	1.1627	0.314–0.366	0.315
Nitromethane	CH_3NO_2	25	1.1367	0.289–0.349	0.307
Nitrobenzene	$C_6H_5NO_2$	25	...	0.0019	...
Acetone	$(CH_3)_2CO$	0	0.8227	1.732	2.105
Acetone	$(CH_3)_2CO$	25	0.7968	1.038	1.302
Furfurol	$C_4H_3O.COH$	0	...	15.10	...
Furfurol	$C_4H_3O.COH$	25	1.2014	5.62	4.94
Benzaldehyde	C_6H_5COH	25	1.0446	0.343	0.328
Salicylic Aldehyde	$C_6H_4.OH.COH$	0	1.1501	1.257	1.093
Salicylic Aldehyde	$C_6H_4.OH.COH$	25	1.1373	0.549	0.483
Anisic Aldehyde	$C_6H_4.OCH_3.COH$	0	1.1223	1.520	1.355
Anisic Aldehyde	$C_6H_4.OCH_3.COH$	25	1.1180	0.720	0.644
Ethyl Acetate	$CH_3COOC_2H_5$	25	...	0.0013	...
Methyl Cyanacetate	$CH_2CNCOOCH_3$	0	1.1521	3.256	2.827
Methyl Cyanacetate	$CH_2CNCOOCH_3$	25	1.1358	2.459	2.165
Ethyl Cyanacetate	$CH_2CNCOOC_2H_5$	25	1.0628	0.989	0.930

Solubility of Potassium Iodide at 20° in Several Solvents Containing Dissolved Iodine.
(Olivari, 1908.)

Solvent.	Gm. Mols. KI per Liter in Solvent Containing: 0.5 Gm. Mols. I_2 per Liter.	1.5 Gm. Mols. I_2 per Liter.	2.5 Gm. Mols. I_2 per Liter.
Acetic Acid	0.511	1 460	2 080
Ethyl Acetate	0.490	1.400	1 980
Ethyl Alcohol	0 520	1.220	1.730
Nitrobenzene	0.414	0.960	1.380
Ethylbromide	0.140	0.350	...

Equilibrium in the System Potassium Iodide — Ethyl Ether — Water at 20°.
(Dunningham, 1914.)

Gms. per 100 Gms Upper Layer. KI.	H_2O.	$(C_2H_5)_2O$.	Gms per 100 Gms. Lower Layer. KI.	H_2O.	$(C_2H_5)_2O$.	Solid Phase.
...	...	...	59.2	40 8	...	KI
0.	3.9	96.1	0	93	7	None
0.4	0.4	99 2	55.6	40 7	3.7	KI
0.1	2.2	97.7	25	72.1	2.9	None

Distribution of Potassium Iodide between Water and:

Nitrobenzene at 18°. (Dawson, 1908.)

Mols KI per Liter. $C_6H_5NO_2$ Layer.	H_2O Layer.	Dist. Ratio.
0.00114	6.05	5300
0.00108	6 05	5600

Phenol at Room Temp. (Riesenfeld, 1902.)

Gms KI per 100 cc. C_6H_5OH Layer.	Aq. Layer.	Dist. Ratio.
0 052	0.725	13 2
0 197	2.42	12.3
2 09	30 7	14.7

Freezing-point data for KI + K_2SO_4 and KI + NaCl are given by Ruff and Plato (1903). Results for KI + AgI are given by Sandonnini (1912a). Results for KI + SO_2 are given by Walden and Centnerszwer (1903).

POTASSIUM IODOMERCURATE (Thoulet Solution).

A sat. solution at 22.9°, prepared by adding KI and HgI_2 in excess to water, contained 8.66% K, 22.49% Hg, 52.58 (57.7) % I and 10.97 (11.15)% H_2O, corresponding to 0.22 mol. alkali, 0.11 mol. Hg and 0.45 mol. I. (Duboin, 1905.)

POTASSIUM MOLYBDATE K_2MoO_4

Solubility of Potassium Molybdate in Aqueous Solutions of Potassium Sulfate at 25° and Vice Versa.
(Amadori, 1912a).

Gms. per 100 Gms. H_2O. K_2SO_4.	K_2MoO_4.	Gms per 100 Gms. H_2O. K_2SO_4.	K_2MoO_4.
0	184.6	1 50	99.49
0 46	180 7	2.13	45.89
0 72	177	3 95	17.48
0 98	127.2	8.55	4.73
1 27	107 5	12 10	0

Freezing-point data for K_2MoO_4+ K_2SO_4, K_2MoO_4 + K_2WO_4 and $K_2Mo_2O_7$ + $K_2W_2O_7$ are given by Amadori (1913).

POTASSIUM NITRATE KNO_3.

Solubility Ice Curve and Supersolubility Ice Curve.
(Jones, 1908.)

t° of Cryst.	Gms. KNO_3 per 100 Gms. H_2O. Solubility Ice Curve.	Supersolubility Ice Curve.	t° of Cryst.	Gms KNO_3 per 100 Gms. H_2O. Solubility Ice Curve.	Supersolubility Ice Curve.
−1	3.336	1.011	−3	...	5.762
−2	7.582	3.538	−4	...	8.694
−2.8*	11.62	5.56	−5	...	11.12
			−5.3*	...	11.82

* Cryohydrate.

Solubility in Water.

(Mulder; Andrae, 1884; Gerardin, 1865; Etard, 1894; Ost, 1878; at 31.25°, Köhler, 1897; Euler, 1904; Tilden and Shenstone, 1884; Berkeley, 1904.)

Average Curve.

t°.	Gms. KNO_3 per 100 Gms. Water.	Gms. KNO_3 per 100 Gms. Solution.	t°.	Gms. KNO_3 per 100 Gms. Water.	Gms. KNO_3 per 100 Gms. Solution.
0	13.3	11.7	70	138	58.0
10	20.9	17.3	80	169	62.8
20	31.6	24.0	90	202	66.9
25	37.3	27.2	100	246	71.1
30	45.8	31.4	110	300	75.0
40	63.9	39.0	120	394	79.8
50	85.5	44.0	125	493	83.1
60	110.0	52.0			

The very carefully determined figures of Berkeley are as follows:

t°.	d_4 of Sat. Sol.	Gms. KNO_3 per 100 Gms. H_2O.	t°.	d_4 of Sat. Sol.	Gms. KNO_3 per 100 Gms. H_2O.
0.40	1.0817	13.43	60.05	1.3903	111.18
14.90	1.1389	25.78	76	1.4700	156.61
30.80	1.2218	47.52	91.65	1.5394	210.20
44.75	1.3043	74.50	114 b. pt.	1.6269	311.64

1000 gms. H_2O dissolve 384.48 gms. KNO_3 at 25°. (Armstrong and Eyre, 1910–11.)
One liter sat. solution in water contains 2.8 mols. = 283.11 gms. KNO_3 at 20°. (Rosenheim and Weinheber, 1910–11.)
Recent determinations of the solubility of potassium nitrate in water, agreeing satisfactorily with the above data, are given by Chugaev and Khlopin (1914).

Solubility of Mixtures of Potassium Nitrate and Barium Nitrate in Water.

(Euler — Z. physik. Ch. 49, 313, '04)

t°.	Sp. Gr. of Sat. Solution.	Grams per 100 Grams H_2O.
17	1.120	13.26 KNO_3 + 6.31 $Ba(NO_3)_2$
21.5	...	17.00 " + 7.58 "
30	1.191	24.04 " + 9.99 "
50	...	49.34 " + 18.09 "

Solubility of Potassium Nitrate in Aqueous Solutions of Nitric Acid at 0°.

(Engel — Compt. rend. 104, 913, '87)

Sp. Gr. of Solutions.	Equivalents per 10 cc. Solution.		Grams per 100 cc. Solution.	
1.079	12.5 KNO_3	0 HNO_3	12.65 KNO_3	0.00 HNO_3
...	9.9 "	5.87 "	10.02 "	3.71 "
1.093	8.28 "	13.2 "	8.38 "	8.38 "
1.117	7.4 "	21.55 "	7.49 "	13.58 "
1.144	7.4 "	31.1 "	7.49 "	19.47 "
1.202	7.6 "	48.0 "	7.68 "	30.04 "
1.289	10.3 "	68.0 "	10.42 "	42.86 "
1.498	28.3 "	120.5 "	28.64 "	75.95 "

Freezing-point data for KNO_3 + HNO_3 are given by Dernby (1918).

Solubility of Potassium Nitrate and of Acid Potassium Nitrates in Nitric Acid.

(Groschuff — Ber. 37, 1490, '04.)

Note. — Determinations made by the so-called thermometric method, *i.e.*, by observing the temperature of the disappearance of the separated, finely divided solid from solutions of known concentration.

t°.	Grams per 100 Gms. Solution.		Solid Phase.	t°.	Gms. per 100 Gms. Solution.		Solid Phase.
	KNO_3.	HNO_3.			KNO_3.	HNO_3.	
−6	24.4	75.41	$KNO_3.2HNO_3$ (1)	22.5	47.2	52.93	KNO_3HNO_3
+14	32.6	67.42	" (stabil)	23.5	47.8	52.11	" (stabil)
17	34.8	65.04	"	25.5	48.6	51.46	"
19.5	37.2	62.90	"	27.0	49.4	50.78	"
22	44.5	55.46	"	29.0	50.1	49.94	KNO_3HNO_3
21.5	47.8	52.11	$KNO_3.2HNO_3$ (2)	30.5	50.9	49.15	" (labil)
21.5	48.6	51.46	" (labil)	21.0	49.4	50.78	KNO_3 (labil)
20	50.9	49.15	"	39.0	50.9	49.15	" (stabil)
−4	37.2	62.81	KNO_3HNO_3	50	51.7	48.32	
−16.5	44.5	55.46	" (labil)				

(1) Solution in HNO_3. (2) Solution in KNO_3.

Conduct of Acid Potassium Nitrate Towards Water.

t°.	Gms. per 100 Gms. Solution.		Solid Phase.	t°.	Gms. per 100 Gms. Solution.		Solid Phase.
	KNO_3.	HNO_3.			KNO_3	HNO_3.	
22	44.5	55.5	$KNO_3.2HNO_3$	50	38.7	48.3	KNO_3
20.5	44.1	55.0	"	61	36.0	44.8	"
18	43.8	54.5	"	63	34.5	43.0	"
12	43.0	53.6	"	60.5	30.9	39.5	"
6	42.3	52.7	"	56	27.6	34.4	"
0	41.6	51.8	"	43	20.8	25.9	"
12	41.3	51.4	KNO_3	17	11.7	14.6	"
22	40.9	51.0	"	−5	5.54	6.91	"
40	39.9	49.8	"				

Solubility of Mixtures of Potassium Nitrate and Potassium Chloride in Water.

(Etard — Ann. chim. phys. [7] 3, 283, '94; at 20°, Rüdorff — Ber. 6, 482, '73; Nicol — Phil. Mag. [5] 31, 385, '91)

t°.	Gms. per 100 Gms. Solution.		t°.	Gms. per 100 Gms. Solution.		t°.	Gms. per 100 Gms. Solution.	
	KNO_3.	KCl.		KNO_3.	KCl.		KNO_3.	KCl.
0	5.0	20.0	30	16.0	21.2	70	39.5	17.5
10	8.0	20.8	40	21.0	21.0	80	45.5	15.8
20	12.6	21.2	50	27.0	20.0	100	57.5	11.6
25	14.0	21.3	60	33.5	19.0	120	69.0	7.7

Solubility of Potassium Nitrate in Aqueous Solutions of:

(Touren — Compt. rend. 131, 259, '00.)

Potassium Carbonate.

Results at 14.5°.

Mols. per Liter. K_2CO_3.	Mols. per Liter. KNO_3.	Gms. per Liter. K_2CO_3.	Gms. per Liter. KNO_3.
0.0	2.228	0.0	225
0.48	1.85	66.4	188
1.25	1.39	172.9	141
2.58	0.86	356.9	87
3.94	0.64	544.9	65

Results at 25°.

Mols. per Liter. K_2CO_3.	Mols. per Liter. KNO_3.	Gms. per Liter. K_2CO_3.	Gms. per Liter. KNO_3.
0.0	3.217	0.0	326
0.59	2.62	81.6	265
1.35	1.97	186.7	199
2.10	1.46	290.5	148
2.70	1.14	373.6	115
3.58	0.79	495.1	80

Potassium Bi Carbonate.

Results at 14.5°.

Mols. per Liter. $KHCO_3$.	Mols. per Liter. KNO_3.	Grams per Liter. $KHCO_3$.	Grams per Liter. KNO_3.
0.0	2.33	0.0	236
0.39	2.17	39.0	220
0.76	2.03	76.0	205
1.16	1.92	116	194
1.55	1.81	155	183

Results at 25°.

Mols. per Liter. $KHCO_3$.	Mols. per Liter. KNO_3.	Grams per Liter. $KHCO_3$.	Grams per Liter. KNO_3.
0.0	3.28	0.0	332
0.89	2.84	89	287
1.33	2.65	133	268
1.91	2.45	191	249

Solubility of Potassium Nitrate in Aqueous Solutions of Potassium Carbonate at 24.2°.

(Kremann and Zitek, 1909.)

Gms. per 1000 Gms. H_2O. KNO_3.	Gms. per 1000 Gms. H_2O. K_2CO_3.	Solid Phase.	Gms. per 1000 Gms H_2O. KNO_3.	Gms. per 1000 Gms H_2O. K_2CO_3.	Solid Phase.
376.8	0	KNO_3	73	688.1	KNO_3
285	130.3	"	38.8	878.3	"
161.7	348.4	"	31.1	1112.2	" $+K_2CO_3$
141.8	371.9	"			

1000 gms. H_2O containing 1 mol. KCl (101.11 gms.) dissolve 324.85 gms. KNO_3 at 25°. (Armstrong and Eyre, 1910–11.)

Data for the system potassium nitrate, potassium sulfate, water at 35° are given by Massink (1916, 1917).

Solubility of Mixtures of Potassium Nitrate and Potassium Sulphate in Water.

(Euler — Z. physik. Ch. 49, 313, '04.)

t°.	Sp. Gr. of Sat. Solution.	Grams per 100 Grams Water.	
15	1.165	24.12 KNO_3	5.65 K_2SO_4
20	...	30.10 "	5.58 "
25	1.210	36.12 "	5.58 "

Solubility of Mixtures of Potassium Nitrate and Sodium Chloride in Water.

(Etard — Ann. chim. phys. [7] 3, 283, '94; the older determinations of Rüdorff, Karsten, Mulder, etc, agree well with those of Etard.)

t°.	Gms. per 100 Gms. Solution. KNO_3.	NaCl.	t°.	Gms. per 100 Gms. Solution. KNO_3.	NaCl.	t°.	Gms. per 100 Gms. Solution. KNO_3.	NaCl.
0	13	24	40	30.5	19	120	73	8.0
10	16	23	50	36	17	140	77	7.0
20	20	22	60	42.5	15	160	79.5	6.0
25	23	21.5	80	55	12	170	80.5	5.5
30	25	20.5	100	67	9.5			

100 gms. H_2O, simultaneously sat. with potassium nitrate and sodium chloride, contain 41.14 gms. KNO_3 + 38.53 gms. NaCl at 25° and 168.8 gms. KNO_3 + 39.81 gms. NaCl at 80°. (Soch, 1898.)

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AND VICE VERSA. (Leather and Mukerji, 1913)

Results at 20°.				Results at 30°.			
Sp. Gr. Sat. Sol.	Gms. per 100 Gms. H_2O. KNO₃.	NaCl.	Solid Phase.	Sp. Gr. Sat Sol.	Gms per 100 Gms. H_2O. KNO₃.	NaCl.	Solid Phase.
1.167	31.49	0	KNO_3	1.261	46.48	9.82	KNO_3
1.220	33.41	9.94	"	1.302	47.08	20.18	"
1.267	34.93	19.44	"	1.343	47.24	29.86	"
1.311	36.41	29.46	"	1.372	49.24	38.72	" +NaCl
1.344	37.30	37.73	" +NaCl	1.342	38.36	38.55	NaCl
1.330	31.41	37.57	NaCl	1.298	25.32	38.23	"
1.283	19 56	37.51	"	1.258	12.15	37.38	"
1.243	9.76	36.73	"	1.202	...	36.30	"
Results at 40°.				Results at 91°.			
1.288	64.74	0	KNO_3	1.552	202 8	0	KNO_3
1.320	64.66	11.32	"	1.573	204.2	12.81	"
...	64.05	23.41	"	1.601	208.1	28.45	"
1.396	64.13	35.08	"	1.645	213.3	37.92	"
1.411	64.77	38.79	" +NaCl	1.660	218 8	39.08	" +NaCl
1.376	52.81	39.51	NaCl	1.607	175.8	40.87	NaCl
1.323	34.98	38.98	"	1.517	126.9	44.33	"
1.267	17 33	37.74	"	1.378	57.53	42.90	"

At the higher temperatures, results for $NaNO_3$ in certain solutions are reported.

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AND VICE VERSA. (Leather and Mukerji, 1913.)

Results at 30°.			Results at 40°.			Results at 91°.			
Sp. Gr. Sat. Sol.	Gms per 100 Gms. H_2O. KNO_3.	$NaNO_3$.	Sp. Gr. Sat. Sol.	Gms per 100 Gms. H_2O KNO_3	$NaNO_3$.	Sp. Gr. Sat. Sol.	Gms. per 100 Gms. H_2O KNO_3	$NaNO_3$	Solid Phase in Each Case.
1.317	45.73	25.90	1.358	63.21	23.85	1.615	200.8	43.4	KNO_3
1.403	47.25	52.53	1.428	63.86	49.79	1.674	207.2	92.90	"
1.472	50.93	79.27	1.505	66.44	79.46	1.751	229.5	156.2	"
1.544	54.34	103.3	1.570	74.06	116.2	1.790	251.8	206.5	" +$NaNO_3$
1.520	47.67	103.1	1.573	68.72	116.7	1.774	211.7	200	$NaNO_3$
1.481	30.25	101.6	1.526	43.92	112.2	1.695	128.5	186	"
1.451	14.30	99.10	1.476	20.33	109.9	1.610	55.75	173.1	"
1.406	0	95.90	1.421	0	105.2	1.521	0	160.8	"

Results at 20° are also given.

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AND VICE VERSA AT 20°.

(Carnelly and Thomson — J. Ch. Soc. 53, 782, '88; Nicol — Phil. Mag. 31, 369, '91.)

KNO_3 in Aq. $NaNO_3$ Solutions.		$NaNO_3$ in Aq. KNO_3 Solutions.	
Grams per 100 Grams H_2O. $NaNO_3$.	KNO_3	Grams per 100 Grams H_2O. KNO_3.	$NaNO_3$.
0	31.6	0	88
10	30 5	10	90
20	31.0	20	92
40	33.0	25	93
60	35.5	30	94
80	41.0	35	96

Solubility of Potassium Nitrate in Aqueous Solutions of Sodium Nitrate and Vice Versa at 10° and at 24.2°.

(Kremann and Zitek, 1909.)

t°.	Gms. per 1000 Gms. H_2O. KNO_3.	$NaNO_3$.	Solid Phase.	t°.	Gms. per 1000 Gms. H_2O. KNO_3.	$NaNO_3$.	Solid Phase.
10	208 9	0	KNO_3	24.2	422	931.3	KNO_3
10	301.9	848.3	" $+NaNO_3$	24.2	437	1019	" $+NaNO_3$
10	0	805	$NaNO_3$	24.2	123.6	910.6	$NaNO_3$
24.2	377 3	0	KNO_3	24.2	0	913	"
24.2	390	346.7	"				

Solubility of Potassium Nitrate in Aqueous Solutions of Silver Nitrate at 30° and Vice Versa.

(Schreinemakers, 1908–09.)

Gms. per 100 Gms Sat. Sol. KNO_3.	$AgNO_3$.	Solid Phase.	Gms per 100 Gms. Sat Sol. KNO_3.	$AgNO_3$.	Solid Phase.
31.3	0	KNO_3	17.38	57.85	$AgNO_3.KNO_3$
30.45	11.51	"	13.44	65.08	"
29.22	23.59	"	11.22	69.01	" $+AgNO_3$
26.58	39 09	"	5.53	71.65	$AgNO_3$
25.02	46.38	" $+AgNO_3.KNO_3$	0	73	"

Solubility of Mixtures of Potassium Nitrate and Silver Nitrate in Water.

(Etard, 1894)

t°.	Gms. per 100 Gms Sol. KNO_3.	$AgNO_3$.	t°.	Gms. per 100 Gms Sol. KNO_3.	$AgNO_3$.	t°.	Gms. per 100 Gms. Sol. KNO_3.	$AgNO_3$.
0	13.5	43	30	26.8	49.4	80	36.2	55.1
10	19	44.7	40	29.6	51 5	100	38.3	55.3
20	23	47	50	32	54	120	40	55.6
25	25	48	60	33 5	54 8	140	41.5	55.8

Solubility of Mixed Crystals of Potassium Nitrate and Silver Nitrate in Water at 25°.

(Herz, 1905; Fock, 1897)

Gms per Liter $AgNO_3$.	KNO_3.	Mg Mols per Liter $AgNO_3$.	KNO_3.	Mol. Per cent $AgNO_3$ in Solution.	Mol. Per cent $AgNO_3$ in Solid Phase.
45.9	321 8	270	3180	7 83	0.2896
110 7	322 6	651 3	3184	16.96	0.6006
176 8	333 7	1040	3298	23.97	0 9040
259.6	364	1528	3597	29.81	1.054
365.6	456 4	2151	4511	32 28	1.604
507 9	387 2	2988	3816	43 85	2 439
745.9	398 6	4388	3960	52 70	8.294

Solubility of Potassium Nitrate in Aqueous Solutions of Strontium Nitrate and Vice Versa at 20° and at 40°.

(Findlay, Morgan and Morris, 1914.)

t°.	Gms. per 100 Gms. Sat Sol. KNO_3.	$Sr(NO_3)_2$.	Solid Phase.	t°.	Gms. per 100 Gms. Sat Sol. KNO_3.	$Sr(NO_3)_2$.	Solid Phase.
20	22 90	5.49	KNO_3	20	12.65	41.12	$Sr(NO_3)_2.4H_2O$
20	21.70	9.17	"	20	10	40.70	"
20	21.01	17.10	"	40	30.26	23.70	KNO_3
20	19.60	31.24	"	40	26 90	38.52	" $+Sr(NO_3)_2.4H_2O$
20	19.49	34.91	"	40	22.50	40.22	$Sr(NO_3)_2.4H_2O$
20	19.69	39.56	" $+Sr(NO_3)_2.4H_2O$	40	11.19	44.19	"
20	17.56	40.37	$Sr(NO_3)_2.4H_2O$	40	0	47.7	"

1000 gms. H_2O, simultaneously saturated with both salts, contain 552 gms. KNO_3 + 1074 gms. $Sr(NO_3)_2$ at 25°. (LeBlanc and Noyes, 1890.)

Solubility of Mixed Crystals of Potassium Nitrate and Thallium Nitrate in Water at 25°.

(Fock.)

Grams per Liter. $TlNO_3$.	Grams per Liter. KNO_3.	Mg. Mols. per Liter. $TlNO_3$.	Mg. Mols. per Liter. KNO_3.	Mol. per cent $TlNO_3$ in Solution.	Sp. Gr. of Solutions.	Mol. per cent $TlNO_3$ in Solid Phase.
0.00	351.0	0.0	3468.2	0.00	1.2632	0.00
2.37	329.0	8.9	3251.5	0.43	1.1903	0.08
6.15	332.4	23.1	3285.1	0.70	1.1956	0.20
17.64	333.7	66.3	3298.1	1.97	1.2050	0.57
49.74	333.3	186.9	3294.4	5.37	1.2196	1.78
63.60	321.0	239.0	3172.4	7.01	1.2436	2.19
86.18	330.5	323.8	3265.8	9.02	1.2617	2.77
123.8	428.3	465.2	4232.6	9.90	1.2950	{ 6.00 / 27.04
101.3	245.1	380.6	2423.3	13.58	1.2050	93.33
116.1	0.0	463.1	0.0	100.00	1.0964	100.00

Solubility of Potassium Nitrate in Aqueous Alcohol Solutions.

(Gerardin — Ann. chim. phys. [4] 5, 151, '65.)

Grams KNO_3 per 100 Grams Aqueous Alcohol of Sp. Gr.:

t°.	0.9904 = 5.5 Wt.%.	0.9843 = 9.35 Wt.%.	0.9793 = 13.6 Wt.%.	0.9726 = 19.1 Wt.%.	.09571 = 30 Wt.%.	0.939 = 40 Wt.%.	0.8967 = 60 Wt.%.	0.8429 = 90 Wt.%.
10	17	13	10	7	4.5	3	1	0.2
18	22.5	18.5	14.5	10	6.2	4.5	1.6	0.3
20	24	20	16	11	7.0	5	2	0.3
25	29	24.5	20	13.5	9.0	6.5	2.5	0.4
30	36	30	25	17	11.5	8	3.0	0.5
40	52	43	36	27	16.5	11	4	0.6
50	72	61	50	38	23.0	16	6	0.7
60	93	79	69	52	31.0	21	8	1.1

Solubility of Potassium Nitrate in Aqueous Alcohol at 18°

(Bodländer — Z. physik. Ch. 7, 316, '91.)

Sp. Gr. of Solution.	Gms. per 100 cc. Solution C_2H_5OH.	Gms. per 100 cc. Solution H_2O.	Gms. per 100 cc. Solution KNO_3.	Sp. Gr. of Solution.	Gms. per 100 cc. Solution C_2H_5OH.	Gms. per 100 cc. Solution H_2O.	Gms. per 100 cc. Solution KNO_3.
1.1480	...	89.80	25.0	1.0120	23.33	69.81	8.06
1.1085	3.30	87.44	20.11	0.9935	28.11	64.74	6.50
1.1010	5.24	86.26	18.60	0.9585	37.53	54.21	4.11
1.0805	8.69	83.18	16.18	0.9450	42.98	48.15	3.37
1.0755	9.06	83.10	15.39	0.9050	51.23	27.32	1.95
1.0655	14.08	77.93	14.54	0.8722	61.65	24.74	0.83
1.0490	16.27	76.36	12.27	0.8375	69.60	13.95	0.20
1.0375	19.97	72.93	10.8				

Solubility of Potassium Nitrate in Dilute Ethyl Alcohol at 25°.

(Armstrong and Eyre, 1910–11.)

Wt. % C_2H_5OH in Solvent.	Gms. KNO_3 per 100 Gms. Sat. Solution.
0	27.77
1.14	26.69
2.25	25.79
4.41	23.81

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS ALCOHOL AND IN AQUEOUS ACETONE.

(Batnrick, 1896.)

In Aqueous Alcohol.			In Aqueous Acetone at 40°.	
Wt. Per cent Alcohol.	Gms. KNO_3 per 100 Gms. Aq. Alcohol. At 30°.	At 40°.	Wt. Per cent Acetone.	Gms. KNO_3 per 100 Gms. Solvent.
0	45.6	64.5	0	64.5
8.25	32.3	47.1	8.5	51.3
17	22 4	33.3	16.8	38.9
25.7	15.1	24.1	25.2	22.8
35	11.4 (34.4°)	16.7	34.3	24.7
44.9	7	11.6 (44°)	44.1	17
54.3	4.5	7.2 (55°)	53.9	11.9
65	2.7	4.4	64.8	7.2
75 6	1.3	2 (76 3°)	76	3
88	0.4	0.6 (88.5°)	87.6	0.7

100 gms. H_2O saturated with sugar and KNO_3 dissolve 224.7 gms. sugar + 41.9 gms. KNO_3, or 100 gms. of the saturated solution contain 61.36 gms. sugar + 11.45 gms. KNO_3 at 31.25°. (Köhler, 1897.)

SOLUBILITY OF POTASSIUM NITRATE IN AQUEOUS SOLUTIONS OF METHYL ALCOHOL, ETHYL ALCOHOL AND MIXTURES OF THE TWO AT 30°.

(Schreinemakers, 1908–09)

In Aq. CH_3OH. Gms. per 100 Gms Sat. Sol. CH_3OH.	KNO_3.	In Aq. C_2H_5OH. Gms. per 100 Gms Sat Sol. C_2H_5OH.	KNO_3.	In Aq. $(CH_3OH+C_2H_5OH)$.* Gms. per 100 Gms. Sat. Sol. $(CH_3OH+C_2H_5OH)$	KNO_3.
0	31.3	10 1	20.7	0	31.3
7 8	23 3	23 8	12.1	12.7	18.9
17.3	16 3	32 2	9	29 2	12.8
27.8	11.2	43.1	6 1	41	6.7
38.4	7.7	56 9	3 3	47.8	5.1
57	3 8	76.8	0 88	56.4	3.5
98.58	0.43	92.3	0.15	74.8	1.2

* The mixture contained 51 7% CH_3OH and 48.3% C_2H_5OH.

100 gms. trichlorethylene dissolve 0.01 gm. KNO_3 at 15°. (Wester and Bruins, 1914.)
100 cc. anhydrous hydrazine dissolve 14 gms. KNO_3 at room temp. (Welsh and Broderson, 1915)
100 gms. aq. 40 weight % C_2H_5OH, simultaneously saturated with the two salts, dissolve 13.74 gms. KNO_3 + 15.78 gms. NaCl at 25°. (Soch, 1898.)

SIMULTANEOUS SOLUBILITY OF POTASSIUM NITRATE AND SILVER NITRATE IN AQUEOUS 51.6 PER CENT C_2H_5OH AT 30°.

(Schreinemakers, 1908–09.)

Gms. per 100 Gms Sat Solution. KNO_3.	$AgNO_3$.	Solid Phase.
4.8	0	KNO_3
4 55	5.15	"
4 11	16.47	"
4.26	21.28	" $+AgNO_3.KNO_3$
2.62	36.94	$AgNO_3.KNO_3+AgNO_3$
0	37	$AgNO_3$

Fusion-point data (solubilities, see footnote, p. 1), are given for KNO_3 + KNO_2 by Meneghini (1912); for KNO_3 + $AgNO_3$ by Usso (1904); for KNO_3 + $NaNO_3$ by Carveth (1898) and by Hissink (1900); for KNO_3 + $Sr(NO_3)_2$ and KNO_3 + $NaNO_3$ + $Sr(NO_3)_2$ by Harkins and Clark (1915); for KNO_3 + $TlNO_3$ by Van Eyk (1899, 1905).

POTASSIUM NITRITE KNO_2.

SOLUBILITY IN WATER.
(Oswald, 1912, 1914.)

t°.	Gms. KNO_2 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. KNO_2 per 100 Gms. Sat. Sol.	Solid Phase.
− 4.1	16.1	Ice	+ 17.5	74.5*	KNO_2
− 7.6	24.1	"	25	75.75	"
−13.8	40.2	"	40	77	"
−18.6	50.1	"	55	77.5	"
−24.6	61.7	"	75	78.5	"
−30	69.8	"	100	80.5	"
−31.6 Eutec.	71.8	" $+KNO_2$	111	80.7	"
− 6.5	73.2	KNO_2	119	81.15	"
0	73.6	"	125	81.8	"

* $d_{17.4} = 1.6464$.

100 gms. H_2O dissolve about 300 gms. KNO_2 at 15.5°. (Divers, 1899.)
The figure 138.5 gms. KNO_2 per 100 gms. H_2O at 15°, given by von Niementowski and von Roszkowski (1897), is evidently low.

SOLUBILITY OF MIXTURES OF POTASSIUM NITRITE AND OF SILVER NITRITE IN WATER.
(Oswald, 1914.)

Results at 13.5°.		Results at 25°.		Solid Phase in Each Case.
Gms per 100 Gms H_2O.		Gms per 100 Gms. H_2O.		
KNO_2.	$AgNO_2$.	KNO_2.	$AgNO_2$.	
18	2.36	23.1	5.3	$AgNO_2+K_2Ag_2(NO_2)_4.H_2O$
276	26.3	279	39.3	$KNO_2+K_2Ag_2(NO_2)_4.H_2O$

Of the two layers obtained by mixing an equal volume or more of 96% ethyl alcohol with a nearly saturated aqueous solution of KNO_2, the lower contains 71.9% KNO_2 and the upper, alcoholic, 6.9%. With methyl alcohol there is no separation into two layers. (Donath, 1911.)

POTASSIUM OXALATE $K_2C_2O_4.4H_2O$.

SOLUBILITY OF MIXTURES OF POTASSIUM OXALATE AND OXALIC ACID IN WATER AT 25°.
(Foote and Andrew, 1905.)

Gms per 100 Gms. Solution.		Mols per 100 Mols H_2O.		Solid Phase.
$H_2C_2O_4$.	$K_2C_2O_4$.	$H_2C_2O_4$	$K_2C_2O_4$.	
10.2	...	2.274	...	$H_2C_2O_4.2H_2O$
10.31	0.04	2.302	0.005	$H_2C_2O_4.2H_2O+H_3K(C_2O_4)_2.2H_2O$
9.26	0.13	2.046	0.016	Double salt $H_3K(C_2O_4)_2\ 2H_2O$
3.39	0.63	0.707	0.071	"
2.06	4.26	0.440	0.495	$H_3K(C_2O_4)_2.2H_2O+HKC_2O_4$
1.16	11.50	0.266	1.427	Double salt HKC_2O_4
0.99	16.93	0.240	2.235	"
0.85	21.08	0.221	2.928	$HKC_2O_4+H_2K_4(C_2O_4)_3.2H_2O$
0.82	21.49	0.211	2.998	Double salt $H_2K_4(C_2O_4)_3.2H_2O$
0.64	23.52	0.169	3.361	"
0.57	24.88	0.153	3.617	"
0.43	27.52	0.122	4.14	$H_2K_4(C_2O_4)_3\ 2H_2O+K_2C_2O_4.H_2O$
...	27.40	...	4.09	$K_2C_2O_4\ H_2O$

EQUILIBRIUM IN THE SYSTEM POTASSIUM OXALATE, OXALIC ACID, WATER AT 0°, 30° AND 60°.

(Koppel and Cahn, 1908.)

Results at 0°. Gms. per 100 Gms. Sat. Sol.		Results at 30°. Gms. per 100 Gms. Sat. Sol.		Results at 60°. Gms. per 100 Gms. Sat. Sol.		Solid Phase in Each Case.
C_2O_3.	K_2O.	C_2O_3.	K_2O.	C_2O_3.	K_2O.	
2.72	...	9.97	...	24.75	...	$H_2C_2O_4.2H_2O$
2.91	0.226*	10.15	0.10	...	...	"
2.985	0.342*	...	...	...	...	"
2.827	0.125	10.23	0.34	25.70	0,46	" $+KH_3(C_2O_4)_2.2H_2O$
2.345	0.145	...	...	...	...	" "
1.471	0.195	7.28	0.33	25.80	0.54	$KH_3(C_2O_4)_2.2H_2O$
0.823	0.240	4	0.41	22.06	0.58	"
0.799	0.454	3.08	0.50	20.17	0.67	"
1.173	0.785	2.38	1.002	14.25	0.90	"
1.381	0.962	2.98	1.79	9.82	1.48	"
1.545	1.155	...	...	6.95	2.244	"
1.666	1.273	4.24	2.76	9.17	5.60	" $+KHC_2O_4$
1.754	1.479	4.26	3.38	8.81	6 37	KHC_2O_4
2.627	2.858	5 44	5.43	10.17	10	"
3.772	4.422	6.66	7.27	12.36	13.40	"
4.292	5.161	8.64	10.05	14.10	16	"
4.975	6.088	10.03	12.01	15.35	17.80	"
5.652	7	10.80	12.94	16.07	18.89	" $+(K_2C_2O_4)_2H_2C_2O_4.2H_2O$
6.27	7.87	11.47	14.13	16.51	19.59	$(K_2C_2O_4)_2.H_2C_2O_4.2H_2O$
7.63	9.72	12.16	15.11	16.80	20.10	"
8.66	11.14	12.32	15.37	16.95	20.34	"
9.055	11.58	12.90	16.23	17.14	20.70	" $+K_2C_2O_4.H_2O$
8.826	11.52	12.36	16.14	16.71	20.41	$K_2C_2O_4.H_2O$
5.215	12.33	8.52	15.03	15.94	20.11	"
2.23	14.80	4.53	15.55	15.06	19.66	"
1.245	16.82	1.87	18.17	8.82	19.25	"
0.871	18.4	0.74	22.32	2.04	23.09	"
0.511	20.91	...	...	0.434	29	"
0.325	23.30	...	...	0.365	31.40	"
0	41.3†	0	46.79	0	51.34	$KOH.H_2O$

* Supersaturated. † About.

EQUILIBRIUM IN THE SYSTEM POTASSIUM OXALATE, OXALIC ACID, WATER AT 25°.

(Hartley, Drugman, Vlieland and Bourdillon, 1913.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
C_2O_3.	K_2O.		C_2O_3.	K_2O.	
8.29	0	$H_2C_2O_4\ 2H_2O$	3.079	2.052	$KH_3(C_2O_4)_2.2H_2O$
8.278	0.045	"$+KH_3(C_2O_4)_2.2H_2O$	3.450	2.360	" $+KHC_2O_4$
7.412	0.064	$KH_3(C_2O_4)_2.2H_2O$	3.793	3.199	KHC_2O_4
2.827	0.238	"	5.457	5.919	"
2.007	0.346	"	9.816	11.96	" $+2K_2C_2O_4.H_2C_2O_4.2H_2O$
1.734	0.567	"	12.365	15.71	$2K_2C_2O_4.H_2C_2O_4.2H_2O+K_2C_2O_4.H_2O$
2.675	1.714	"	11.85	15.51	$K_2C_2O_4.H_2O$

Similar data at 15° for the above system are given by Jungfleisch and Landrieu (1914a).

SOLUBILITIES IN THE SYSTEM POTASSIUM OXALATE, OXALIC ACID, WATER AT THE CRYOHYDRIC POINTS.

(Koppel and Cahn, 1908.)

(Temp. of Equilibrium of Solution with Ice.)

t° of Ice Separation.	Gms. per 100 Gms. Sat. Sol. C_2O_3.	K_2O.	Solid Phase, Ice+:	t° of Ice Separation.	Gms. per 100 Gms. Sat. Sol. C_2O_3.	K_2O.	Solid Phase, Ice+:
−0.95	2.641	...	$H_2C_2O_4.2H_2O$	− 4.45	6.902	8.820	$(K_2C_2O_4)_2.H_2C_2O_4.2H_2O$
−0.90	2.720	0.0466	" $+KH_3(C_2O_4)_2.2H_2O$	− 5.20	7.616	9.74	"
−0.52	1.672	0.0602	$KH_3(C_2O_4)_2.2H_2O$	− 5.32	7.696	9.84	"
−0.25	0.643	0.210	"	− 5.97	8.51	11.01	" $+K_2C_2O_4.H_2O$
−0.58	1.229	0.823	"	− 6.55	6.742	10.45	$K_2C_2O_4.H_2O$
−0.78	1.648	1.234	" $+KHC_2O_4$	− 8.10	4.999	10.86	"
−1.50	2.707	2.950	KHC_2O_4	−10.30	3.358	11.76	"
−2.10	3.687	4.363	"	−13.60	1.854	13.08	"
−2.78	4.576	5.50	"	−17.40	1.200	14.55	"
−3.45	5.681	7.05	" $+(K_2C_2O_4)_2.H_2C_2O_4.2H_2O$	−23.80	0.606	16.89	"

SOLUBILITIES IN THE SYSTEM POTASSIUM OXALATE, OXALIC ACID, WATER AT THE BOILING POINTS.

(Koppel and Cahn, 1908.)

t° of B. pt.	Gms. per 100 Gms. Sat. Sol. C_2O_3.	K_2O.	Solid Phase.	t° of B. pt.	Gms. per 100 Gms. Sat. Sol. C_2O_3.	K_2O	Solid Phase.
105.5	39.84	5.25	$KH_3(C_2O_4)_2.2H_2O$	102.8	19.10	18.25	KHC_2O_4
104.9	36.95	5.83	"	103.25	21.11	21.71	"
104.3	32.75	5.97	"	107.7	25.19	27.91	" $+K_2C_2O_4.H_2O$
103.4	27.64	9.12	"	106.35	22.04	26.45	$K_2C_2O_4.H_2O$
102.9	27.46	11.43	" $+KHC_2O_4$	106.25	19.17	25.02	"
102.5	23.36	10.50	KHC_2O_4	108.25	12.73	27.69	"
102.4	18.81	12.29	"	111.8	5.35	30.40	"

From the preceding tables the following results for the solubilities of the pure oxalates in water are obtained.

SOLUBILITY OF POTASSIUM OXALATE, $K_2C_2O_4.H_2O$ IN WATER.

t°.	Gms. per 100 Gms. Sat Sol. C_2O_3	+ K_2O	= $K_2C_2O_4$.	Solid Phase.	t°.	Gms. per 100 Gms Sat Sol. C_2O_3	+ K_2O	= $K_2C_2O_4$.	Solid Phase.
− 0.78	1.31	1.71	3.02	Ice	30	12.36	16.14	28.50	$K_2C_2O_4.H_2O$
− 1.49	2.48	3.20	5.68	"	40	13.20	17.22	30.44	"
− 2.50	3.99	5.20	9.195	"	50	14.14	18.46	32.60	"
− 3.22	5.15	6.705	11.855	"	60	15.06	19.66	34.72	"
− 5.88	8.429	11.01	19.43	" $+K_2C_2O_4.H_2O$	70	15.94	20.81	36.75	"
0	8.83	11.52	20.35	$K_2C_2O_4.H_2O$	80	16.86	22.02	38.875	"
+10	10.48	13.69	24.17	"	90.2	17.73	23.14	40.90	"
20	11.57	15.11	26.675	"	106.2*	19.17	25.02	44.19	"

* b. pt.

100 gms. sat. aq. sol. contain 20.62 gms. $K_2C_2O_4$ at 0°, $d = 1.161$. (Engel, 1888.)

The results of Hartley, Drugman, Vlieland and Bourdillon (1913) and of Colani (1916), for the solubility of neutral potassium oxalate in water, agree satisfactorily with the above.

SOLUBILITY OF POTASSIUM BIOXALATE, KHC_2O_4, IN WATER.

(Koppel and Cahn, 1908.)

t°.	Gms. per 100 Gms Sat. Sol. C_2O_3.	K_2O.	Solid Phase.
60	8.75	6.50	KHC_2O_4
102.4 b. pt.	18.81	12.29	"

The KHC_2O_4 is decomposed to the less soluble tetroxalate at temperatures below 50°.

SOLUBILITY OF POTASSIUM TETROXALATE, $KH_3(C_2O_4)_2.2H_2O$, IN WATER.
(Koppel and Cahn, 1908.)

t°.	Gms. $KH_3(C_2O_4)_2$ per 100 Gms. H_2O.	Solid Phase.
−0.25 cryohydrate	0.99	$KH_3(C_2O_4)_2.2H_2O$
0	1.27	"
30	4.30	"
60	11.95	"
103.5 b. pt.	72.17	"

SOLUBILITY OF MIXTURES OF POTASSIUM OXALATE AND OTHER SALTS IN WATER. (Colani, 1916.)

Results at 15°. Gms. per 100 Gms. Sat. Sol.	Results at 50°. Gms. per 100 Gms. Sat. Sol.	Solid Phase in Each Case.
10.03 $K_2C_2O_4$+19.19 KCl	15.18 $K_2C_2O_4$+20.26 KCl	$K_2C_2O_4.H_2O$+KCl
23.55 " + 1.82K_2SO_4	31.06 " + 1.99 K_2SO_4	" +K_2SO_4
20.39 " +11.60 KNO_3(19°)	19.63 " +28.29 KNO_3	" +KNO_3

100 gms. aqueous solution, simultaneously saturated with potassium and sodium oxalates, contain 26.15 gms. $K_2C_2O_4$ + 2.44 gms. $Na_2C_2O_4$ at 25°.
(Foote and Andrew, 1905).

POTASSIUM Telluric Acid OXALATE $K_2[H_6TeO_6.C_2O_4]$.

SOLUBILITY IN WATER. (Rosenheim and Weinheber, 1910–11.)

t°	0°	20°	30°	40°	50°
Gms. $K_2[H_6TeO_6.C_2O_4]$ per 100 gms. H_2O	2.67	5.36	6.82	9.07	12.35

POTASSIUM PERMANGANATE $KMnO_4$.

SOLUBILITY IN WATER. (Baxter, Boylston, and Hubbard, 1906; Patterson, 1906.)

t°.	Gms $KMnO_4$ per 100: Gms. Solution.	Gms H_2O.	cc. Solution (P).	t°.	Gms. $KMnO_4$ per 100: Gms. Solution.	Gms. H_2O.
0	2.75	2.83	2.84	34.8	9.64	10.67
9.8	4.13	4.31	...	40	11.16	12.56
15	...	...	5.22	45	12.73	14.58
19.8	5.96	6.34	...	50	14.45	16.89
24.8	7.06	7.59	...	55	16.20	19.33
29.8	8.28	9.03	8.69	65	20.02	25.03

Sp. Gr. of saturated solution at 15° = 1.035.
Determination by Worden (1907), made with extreme care, gave results in very close agreement with the above.

SOLUBILITY OF POTASSIUM PERMANGANATE IN:

t°.	Water. (Voerman, 1906.) Gms. $KMnO_4$ per 100 Gms. Solution.	Water.	Solid Phase.	Aqueous Acetone Solutions at 13°. (Herz and Knoch, 1904) cc Acetone per 100 cc. Solvent.	$KMnO_4$ per 100 cc. Solution. Millimols.	Grams.
− 0.18	0.58	0.58	Ice	0	148.5	4.70
− 0.27	0.99	1.01	"	10	162.5	5.13
− 0.48	1.98	2.02	"	20	177.3	5.61
− 0.58	2.91	3	Ice+KMnO	30	208.2	6.59
+10	4.01	4.22	$KMnO_4$	40	257.4	8.14
15	4.95	5.20	"	50	289.7	9.16
25	7	7.53	"	60	316.8	10.02
40	10.40	11.61	"	70	328	10.38
50	14.35	16.75	"	80	312.5	9.89
				90	227	7.18
				100	67	2.14

SOLUBILITY OF POTASSIUM PERMANGANATE IN AQUEOUS SOLUTIONS OF POTASSIUM CARBONATE.

(Sackur and Taegener, 1912.)

t°.	Mols. $KMnO_4$ per Liter in: 0.1 n $\frac{1}{2}K_2CO_3$.	1 n $\frac{1}{2}K_2CO_3$.	2 n $\frac{1}{2}K_2CO_3$.	4 n $\frac{1}{2}K_2CO_3$.	6 n $\frac{1}{2}K_2CO_3$.
0	0.1462	0.0629	0.0446	0.027	0.0156
25	0.4375	0.2589	...	0.093	...
40	0.7380	0.5007	0.3519	...	...

SOLUBILITY OF POTASSIUM PERMANGANATE IN AQUEOUS SOLUTIONS OF POTASSIUM CHLORIDE.

(Sackur and Taegener, 1912)

t°.	Mols. $KMnO_4$ per Liter in: 0.1 n KCl.	0.5 n KCl.	1 n KCl.	2 n KCl
0	0.1395	0.076	0.0532	0.0379
25	0.4315	0.306	0.220	0.1432
40	0.738	0.584	0.444	0.288

SOLUBILITY OF POTASSIUM PERMANGANATE IN AQUEOUS SOLUTIONS OF POTASSIUM HYDROXIDE.

(Sackur and Taegener, 1912)

t°.	Mols. $KMnO_4$ per Liter in: H_2O.	1 n KOH.	2 n KOH.	4 n KOH.	6 n KOH.	8 n KOH.	10 n KOH.
0	0.176	0.050	0.031	0.027	0.023	0.017	0.012
10	0.278	0.112	0.068	0.048	0.042	0.028	0.016
20	0.411	0.179	0.119	0.079	0.074 (19°)	0.032	0.029
30	0.573	0.316 (32°)	0.213 (32°)	0.149 (32°)	0.114	0.062 (32°)	0.040
40	0.792	0.439	0.306	0.211	0.161	0.084	0.052
50	1.154 (53°)	0.638	0.462	0.304	0.219	0.111	...
70	1.812	1.172	0.869	0.572	0.390	0.188	0.082
80	...	1.513	1.190	...	0.500	0.231	...
90	...	...	...	...	0.649	0.297	...

SOLUBILITY OF POTASSIUM MANGANATE IN AQUEOUS SOLUTIONS OF POTASSIUM HYDROXIDE.

(Sackur and Taegener, 1912.)

(The K_2MnO_4 was prepared by boiling $KMnO_4$ with very conc. KOH, draining by suction and washing with ice cold K_2CO_3 solution. The impurities were of no consequence since the determinations were made in alkaline solutions.)

t°.	Mols. K_2MnO_4 per Liter in: 2 n KOH.	4 n KOH.	6 n KOH.	8 n KOH.	10 n KOH.
0	0.907	0.554	0.155	0.063	0.0145
10	1.013	...	...	0.070	0.0152
15	...	0.681 (17°)	0.224	...	...
20	1.140	0.733 (25°)	0.261 (23°)	0.078	0.0160
30	1.252	0.772	0.303	0.096	0.0215
40	...	0.852	0.362	0.119	0.0305
45	1.424	0.889	0.388	...	...
50	...	0.938 (51°)	...	0.142	0.0462
60	...	1.003	0.469	0.167	0.062 (63°)
70	...	1.074	0.528	0.196	0.070
80	...	1.143	0.587	0.222	0.083

100 cc. anhy. hydrazine dissolve 2 gms. $KMnO_4$, with evolution of gas and formation of a brown precipitate, at room temp. (Welsh and Broderson, 1915.)

SOLUBILITY OF MIXED CRYSTALS OF POTASSIUM PERMANGANATE AND POTASSIUM PERCHLORATE AT 7°.

(Muthmann and Kuntze, 1894; recalculated by Fock, 1897.)

Milligram Mols. per Liter.		Gms. per Liter.		Mol. per cent $KMnO_4$ in Crystals of Solid Phase.
$KMnO_4$.	$KClO_3$.	$KMnO_4$.	$KClO_4$.	
0	63.91	0	8.86	0
29.37	54.48	4.65	7.55	2.84
67.73	42.75	10.71	5.93	9.78
79.04	39.59	12.50	5.49	10.81
99.81	38.63	15.79	5.36	15.96
122.24	34.39	19.34	4.77	23.56
119.21	38.91	18.84	5.39	24.28
128.08	33.77	20.26	4.68	26.40
144.46	33.14	22.86	4.59	34.32
167.81	29.53	26.55	4.09	44.42
183.09	25.19	28.97	3.49	67.33
197.82	20.16	31.30	2.80	77.95
233.75	28.26	36.98	3.92	94.37
264.27	0	41.81	0	100

SOLUBILITY OF MIXED CRYSTALS OF POTASSIUM PERMANGANATE AND RUBIDIUM PERMANGANATE AT 7°.

(Muthmann and Kuntze, calc. by Fock)

Milligram Mols. per Liter.		Gms per Liter.		Mol. per cent $KMnO_4$ in Crystals of Solid Phase.
$KMnO_4$.	$RbMnO_4$.	$KMnO_4$	$RbMnO_4$.	
27.04	22.69	4.28	4.64	3.50
75	22.22	11.84	4.54	13.75
120.26	31.29	19.03	6.40	34.29
188.30	38.98	29.80	7.97	71.45
198.36	41.29	31.39	8.44	92.50
205 76	42.50	32.56	8.69	99.47
225 12	26	35.61	5.32	99.32
264.27	0	41.81	0	100

POTASSIUM PICRATE $C_6H_2(NO_2)_3OK$.

Data for the solubility of potassium picrate in aqueous solutions of ethyl alcohol, methyl alcohol and of acetone at 25° are given by Fisher (1914).

POTASSIUM PHOSPHATES

SOLUBILITY OF POTASSIUM ACID PHOSPHATE, $KH_2PO_4.H_3PO_4$, IN WATER.

(Parravano and Mieli, 1908)

Determinations by Synthetic (sealed tube) Method.

t°.	Gms $KH_2PO_4\,H_3PO_4$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $KH_2PO_4\,H_3PO_4$ per 100 Gms. Sat. Sol.	Solid Phase.
−0.6	3.337	Ice	65.2	68.44	KH_2PO_4
−2.5	12.13	"	78	72.43	"
−6.7	29.43	"	87.5	77.6	"
− 9.2	36.98	"	105.5	85.9	"
−13 Eutec.	44	" $+KH_2PO_4$	120 tr. pt.	92.1	" $+KH_2PO_4.H_3PO_4$
0 (?)	45.8	KH_2PO_4	135	96.1	$KH_2PO_4.H_3PO_4$
+10.9	50.3	"	139	100	

One liter of sat. aq. solution contains 249.9 gms. KH_2PO_4 at 7°. (Muthmann and Kuntze, 1894.)

SOLUBILITY OF POTASSIUM ACID PHOSPHATE, $KH_2PO_4.H_3PO_4$, IN ANHYDROUS PHOSPHORIC ACID.

(Parravano and Mieli, 1908.)

Determinations by Synthetic (sealed tube) Method.

t°.	Gms per 100 Gms. Sat. Solution. $KH_2PO_4.H_3PO_4$	=	KH_2PO_4.
38.5	18.17		10.56
84	58.42		33.97
110	77.53		45.08
126.5	92.26		51.90

EQUILIBRIUM IN THE SYSTEM POTASSIUM HYDROXIDE, PHOSPHORIC ACID, WATER AT 25°.

(D'Ans and Schreiner, 1910a; Parker, 1914.)

The results of these investigators agree satisfactorily when plotted on cross-section paper. The following figures were read from the curves. Some uncertainty exists in regard to the solid phase in contact with some of the solutions.

Mols. per 1000 Gms Sat. Sol. K.	PO_4	Solid Phase.	Mols per 1000 Gms Sat Sol K.	PO_4	Solid Phase.
9.62	0	$KOH\ 2H_2O$	7	4	$K_3PO_4+K_2HPO_4$
9.76	0.24*	" $+K_3PO_4\ 3H_2O$	6	3.6	K_2HPO_4
9.15	0.5	$K_3PO_4.3H_2O$	5	3.15	"
8.2	1	"	4	2.65	" or KH_2PO_4(?)
7.5	1.5	"	3	2.2	" " (?)
8.2	2	"	2	1.7	" " (?)
7.5	2.5	"	1.5	1.5	" " (?)
8.8	2.9	"	1.6	2	KH_2PO_4
9.7	2.9	" $+K_3PO_4$	2.1	4	"
9.5	3	K_3PO_4	2.5	6	"
8.5	3.4	"	3	8	"
8	3.6	"	1.65	6	$KH_2PO_4.H_3PO_4$ (Parker)
7.5	3.75	"	1.35	8	" "

Fusion-point data for $KPO_3 + K_4P_2O_7$ are given by Parravano and Calcagni (1908, 1910).

POTASSIUM HYPOPHOSPHATE, etc.

SOLUBILITY IN WATER.

(Salzer — Liebig's Ann. 211, 1, 82.)

Salt.	Formula.	Gms. Salt per 100 Gms. H_2O. Cold	Hot.
Potassium Hypophosphate	$K_4P_2O_6.8H_2O$	400	...
" Hydrogen Hypophosphate	$K_3HP_2O_6.3H_2O$	200	...
" Di Hydrogen Hypophosphate	$K_2H_2P_2O_6.3H_2O$	33	100
" Tri Hydrogen Hypophosphate	$KH_3P_2O_6$	66.6	200
" Penta Hydrogen Hypophosphate	$K_3H_5(P_2O_6)_2.2H_2O$	40	125
" Hydrogen Phosphite	KH_2PO_3	172 (20°)	...
" Hypophosphite	KH_2PO_2	200 (25°)	333
" Hypophosphite	KH_2PO_2*	14.3 (25°)	28

* Solvent alcohol.

POTASSIUM PHOSPHOMOLYBDATE $K_3PO_4.11MoO_3.1\frac{1}{2}H_2O$.

100 gms. H_2O dissolve 0.0007 gm. at 30°.
100 gms. aqueous 10% HNO_3 dissolve 0.204 gm. at 30°. (Donk, M. G., 1905.)

POTASSIUM SELENATE K_2SeO_4.

SOLUBILITY IN WATER.

t°.	−20°.	−5°.	+5°.	18°.	97°.
Gms. K_2SeO_4 per 100 gms. solution	51.5	51.7	52	52.6	54.9

(Etard, 1894.)

100 gms. H_2O dissolve 115 gms. K_2SeO_4 at 12°. (Tutton, 1907.)

POTASSIUM SILICATE K_2SiO_3.

Data for equilibrium in the systems $K_2SiO_3 + H_2O$, $K_2Si_2O_5 + H_2O$, $K_2SiO_3 + SiO_2$, $SiO_2 + H_2O$ and $K_2SiO_3 + SiO_2 + H_2O$, at temperatures between 200° and 1000° +, determined by the "hydrothermal quenching method," are given by Morey (1917).

POTASSIUM STANNATE $K_2SnO_3.3H_2O$.

100 gms. H_2O dissolve 106.6 gms. at 10°, and 110.5 gms. at 20°. Sp. Gr. at 10° = 1.618 at 20° = 1.627. (Ordway, 1865.)

POTASSIUM SULFATE K_2SO_4.

SOLUBILITY IN WATER.

(Mulder; Andrae, 1884; Trevor, 1891; Tilden and Shenstone, 1884; Berkeley, 1904; see also Etard, 1894.)

t°.	Gms K_2SO_4 per 100 Gms. Water	Solution	t°.	Gms K_2SO_4 per 100 Gms. Water	Solution	t°.	Gms K_2SO_4 per 100 Gms. Water	Solution.
0	7.35	6.85	40	14.76	12.86	90	22.8	18.57
10	9.22	8.44	50	16.50	14.16	100	24.1	19.42
20	11.11	10	60	18.17	15.38	120	26.5	20.94
25	12.04	10.75	70	19.75	16.49	143	28.8	22.36
30	12.97	11.48	80	21.4	17.63	170	32.9	24.76

Sp. Gr. of solution saturated at 18° = 1.083.

The determinations of Berkeley (1904), which were made with exceptional care, are as follows:

t°.	Sp. Gr. of Sat. Solution.	Gms. K_2SO_4 per 100 Gms H_2O.	t°.	Sp. Gr. of Sat. Solution.	Gms. K_2SO_4 per 100 Gms H_2O.
0.40	1.0589	7.47	58.95	1.1089	18.01
15.70	1.0770	10.37	74.85	1.1157	20.64
31.45	1.0921	13.34	89.70	1.1194	22.80
42.75	1.1010	15.51	101.1 b. pt.	1.1207	24.21

Individual determination in good agreement with the above, are given by LeBlanc and Schmandt (1911); Greenish and Smith (1901); Osaka (1903–8); Nacken (1910); Smith and Ball (1917).

SOLUBILITY OF MIXED CRYSTALS OF POTASSIUM SULFATE AND AMMONIUM SULFATE AT 25°.

(Fock, 1897.)

Grams per Liter. K_2SO_4.	$(NH_4)_2SO_4$.	Milligram Mols. per Liter. K_2SO_4.	$(NH_4)_2SO_4$.	Mol. per cent K_2SO_4 in Solution.	Sp. Gr. of Solution.	Mol. per cent K_2SO_4 in Solid Phase.
127.9	0.0	734	0.0	100	1.086	100
135.7	115.7	778.5	874.6	47.1	1.149	91.28
84.20	281.1	483	2126	18.5	1.200	80.05
59.28	355.0	340	2685	11.13	1.226	68.63
40.27	482.7	231	3650	5.98	1.246	27.53
0.00	542.3	0.0	4100	0.00	1.245	0.00

Results are also given for 14°, 15°, 16°, 30°, 46°, and 47°.

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS AMMONIA SOLUTIONS AT 20°.
(Girard, 1885.)

Gms. NH_3 per 100 cc. solution	0	6.086	15.37	24.69	31.02
Gms. K_2SO_4 per 100 cc. solution	10.80	4.10	0.83	0.14	0.04

One liter sat. solution in water contains 105.7 gms. K_2SO_4 at 20°.
One liter sat. solution in 5.2% NH_3 contains 45.2 gms. K_2SO_4 at 20°.
(Konowalow, 1899b.)

SOLUBILITY DATA FOR THE RECIPROCAL SALT PAIR
$K_2SO_4 + BaCO_3 \rightleftarrows K_2CO_3 + BaSO_4$.
(Meyerhoffer, 1905.)

t°.	Gms. per 100 Gms. Sat Sol. K_2SO_4	K_2CO_3	Solid Phase.	t°.	Gms. per 100 Gms. Sat Sol. K_2SO_4	K_2CO_3	Solid Phase.
25	10.76	0	$K_2SO_4+BaSO_4$	25	0.602	7.35	$BaCO_3+BaSO_4$
25	6.76	5.85	" "	25	0.173	2.85	"
25	3.92	12.6	" "	80	0.613	2.49	"
25	2.485	17.81	" "$+BaCO_3$	80	1.39	4.88	"
25	1.72	22.1	$K_2SO_4+BaCO_3$	80	7.1	15.33	"$+K_2SO_4$
25	0.0886	28.5	" "	100	0.797	2.36	$BaCO_3+BaSO_4$
25	0.023	53.1	" $+K_2CO_3.2H_2O$	100	1.83	4.51	" "
25	0	53.2	$K_2CO_3.2H_2O+BaCO_3$	100	9.42	13.6	" $+K_2SO_4$

SOLUBILITY OF MIXED CRYSTALS OF POTASSIUM COPPER SULFATE AND AMMONIUM COPPER SULFATE IN WATER.

$CuSO_4.K_2SO_4.6H_2O$ and $CuSO_4(NH_4)_2SO_4.6H_2O$ at 13°–14°. (Fock, 1897.)

Mols per 100 Mols. H_2O. K Salt.	NH_4 Salt.	Mol per cent K Salt. in Solution.	in Solid.	Mols. per 100 Mols H_2O. K Salt.	NH_4 Salt	Mol. per cent K Salt. in Solution.	in Solid.
0	1.035	0	0	0.2946	0.5096	36.63	58.20
0.0897	0.8618	5.06	10.34	0.3339	0.3319	50.15	75.34
0.2269	0.6490	16.76	33.05	0.4560	0.1961	69.93	83.86
0.2570	0.5887	30.40	46.22	0.4374	0	100	100

SOLUBILITY OF SOME POTASSIUM DOUBLE SULFATES IN WATER AT 25°.
(Locke, 1902.)

Double Salt.	Formula.	Gms. Anhydrous Salt per 100 Gms. H_2O.
Potassium Cobalt Sulfate	$K_2Co(SO_4)_2.6H_2O$	12.88
" Copper "	$K_2Cu(SO_4)_2.6H_2O$	11.69
" Nickel "	$K_2Ni(SO_4)_2.6H_2O$	6.88
" Zinc "	$K_2Zn(SO_4)_2.6H_2O$	13.19

SOLUBILITY OF POTASSIUM NICKEL SULFATE AND ALSO OF POTASSIUM ZINC SULFATE IN WATER, EACH SEPARATELY DETERMINED AT DIFFERENT TEMPERATURES.

t°.	Gms. per 100 Gms H_2O. $K_2Ni(SO_4)_2.6H_2O$.	$K_2Zn(SO_4)_2.6H_2O$.	t°.	Gms. per 100 Gms. H_2O. $K_2Ni(SO_4)_2.6H_2O$.	$K_2Zn(SO_4)_2.6H_2O$.
0	6	13	40	23	45
10	9	19	50	28	56
20	14	26	60	35	72
25	16	30	70	43	88
30	18	35			

Solubility of the Three Hydrates of Potassium Ferrosulfate in Water at Different Temperatures.

(Küster and Thiel, 1899.)

t°.	$K_2SO_4.FeSO_4.6H_2O$. cc. N/10 $KMnO_4$ per 2cc. Solution.	$K_2SO_4.FeSO_4.6H_2O$. Gms $K_2SO_4.FeSO_4$ per 100 cc. Sol.	$K_2SO_4.FeSO_4.4H_2O$. cc. N/10 $KMnO_4$ per 2 cc. Solution.	$K_2SO_4.FeSO_4.4H_2O$. Gms. $K_2SO_4.FeSO_4$ per 100 cc. Sol.	$K_2SO_4.FeSO_4.2H_2O$. cc. N/10 $KMnO_4$ per 2 cc. Solution.	$K_2SO_4.FeSO_4.2H_2O$. Gms. $K_2SO_4.FeSO_4$ per 100 cc. Sol.
0.5	12.4	18.36	15.5	22.94	15.4	26.79
17.2	17.0	25.16	18.1	26.79	21.6	31.98
40.1	24.8	36.72	21.9	32.41	27.6	40.86
60	29.0	42.93	24.1	35.68	28.8	42.63
80	30.6	45.29	27.3	40.46	28.6	42.34
90	...	...	29.6	43.82	28.9	42.73
95	...	...	29.8	44.11	27.7	41.01

Solubility of Mixtures of Potassium and Lead Sulfates and of Potassium and Strontium Sulfates in Water.

(Barre, 1909.)

Results for $K_2SO_4 + PbSO_4$.

t°.	Gms. K_2SO_4 per 100 Gms. Sat. Sol.	Solid Phase.
7	0.56	$PbSO_4.K_2SO_4$
17	0.62	"
50	1.09	"
75	1.37	"
100	1.69	"

Results for $K_2SO_4 + SrSO_4$.

t°.	Gms. K_2SO_4 per 100 Gms. Sat Sol.	Solid Phase.
17.5	1.27	$K_2SO_4.SrSO_4+SrSO_4$
50	1.88	"
75	2.71	"
100	3.90	"

Solubility of Potassium Sulfate in Aqueous Solutions of Potassium Chloride, Bromide, and Iodide.

(Blarez, 1891.)

Interpolated from the original results.

Grams Halogen Salt per 100 cc. Solution.	Grams K_2SO_4 per 100 cc. in Aq. Solutions of: KCl at 12.5°.	KBr at 14°.	KI at 12.5°.
0	9.9	10.16	9.9
2	8.3	9.1	9.2
4	7.0	8.2	8.4
6	5.7	7.4	7.7
8	4.6	6.6	7.2
10	3.5	6.0	6.6
12	...	5.5	6.0

Solubility of Potassium Sulfate in Aqueous Solutions of Potassium Hydroxide at 25°.

(D'Ans and Schreiner, 1910.)

Mols. per 1000 Gms. Sat. Solution. $(KOH)_2$.	K_2SO_4.	Gms. per 100 Gms. Sat. Solution. KOH.	K_2SO_4.	Mols. per 1000 Gms. Sat. Solution. $(KOH)_2$.	K_2SO_4.	Gms. per 100 Gms. Sat. Solution. KOH.	K_2SO_4.
0	0.617	0	10.75	2.86	0.035	32.06	0.61
0.258	0.433	2.892	7.544	3.42	0.009	38.33	0.16
0.433	0.280	4.854	4.878	4.809	0	53.51	0
1.13	0.137	12.67	2.386				

Solubility of Mixed Crystals of Potassium Sulfate and Potassium Chromate at 25°

(Fock, 1897.)

Milligram Mols. per Liter. K_2SO_4.	K_2CrO_4.	Grams per Liter. K_2SO_4.	K_2CrO_4.	Mol. per cent K_2SO_4 in Solution.	Sp. Gr. of Solution.	Mol. per cent K_2SO_4 in Solid Phase.
618.1	0.0	107.7	0.00	100.0	1.083	100.0
608.4	103	106.0	20.02	85.51	1.092	99.65
341.0	691.8	59.46	134.5	33.01	1.141	97.30
174.8	1496.0	30.47	290.5	10.50	1.231	91.97
110.7	2523	19.30	490.5	4.21	1.356	28.43
100.6	2687	17.54	522.3	3.60	1.377	2.41
0.0	2847	0.0	553.5	0.00	1.398	0.00
734.0	0.0	127.9	0.0	100 0	1.0863	100.0
617.0	103.4	107.6	20.1	85.65	1.0934	99.78
463	452.7	80.72	88.0	55.55	1.1235	98.49
279	948.2	48.64	184.4	22.72	1.1700	96.07
153	1469	26.68	285.6	9.41	1.2255	85.77
296	2681	51.61	521.2	21.09	1.3688	25.73
0.0	2715	0.00	527.8	0.00	1.3781	0.00

Solubility of Potassium Sodium Sulfates in Water.

Double Salt.	t°.	Gms per 100 Gms. H_2O.	Authority.
$3K_2SO_4.Na_2SO_4$	103.5	40.8	(Penny, 1855.)
$5K_2SO_4.Na_2SO_4$	4.4	9.2	(Gladstone, 1854.)
"	12.7	10.1	
"	100	25	

Solubility of Potassium Sulfate in Aqueous Solutions of Sodium Sulfate.

Results at 25°. (Smith and Ball, 1917.) Gms. per 100 Gms. H_2O. Na_2SO_4.	K_2SO_4	Results at 34° and at 60°. (Nacken, 1910.) Gms. per 100 Gms. Sat Sol at 34° Na_2SO_4.	K_2SO_4.	Gms per 100 Gms. Sat Sol. at 60°. Na_2SO_4.	K_2SO_4.	Solid Phase at 34° and at 60°.
0	12.05	0	11.9	0	15.3	K_2SO_4
1.78	12.33	7.1	10.7	6.6	13.9	" +Glaserite
3.58	12.65	31.4	4.3	27.1	8.2	Na_2SO_4+Mix crystals
5.38	12.89	33.1	0	31.3	0	Na_2SO_4
7.19	13.12					

Additional data for the above system at 15°, 25°, 40°, 50°, 60°, 70° and 80° are given by Okada (1914). The results show that potassium and sodium sulfates form a double salt of the composition $K_3Na(SO_4)_2$. This double salt dissolves sodium sulfate as a solid solution but not potassium sulfate.

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 18°.

(Stortenbecker, 1902.)

Mols. per 100 Mols. $K_2SO_4+H_2SO_4+H_2O$		Solid Phase.	Mols. per 100 Mols. $K_2SO_4+H_2SO_4+H_2O$.		Solid Phase.
K_2SO_4.	H_2SO_4.		K_2SO_4.	H_2SO_4.	
1.10	0	K_2SO_4	2.80	5.79	$K_2SO_4.3KHSO_4$
1.59	0.95	"	2.61	5.61	$K_2SO_4.6KHSO_4$
2.49	2.70	"	2.25	6.19	" $+KHSO_4$
2.75	3.17	$K_2SO_4.KHSO_4$	1.08	7.94	$KHSO_4$
2.75	3.74	"	0.77	9.2	"
2.83	5.08	"	0.44	22.7	"

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 0°.

(D'Ans, 1909a.)

Mols. per 1000 Gms. Sat. Sol.		Solid Phase.	Mols. per 1000 Gms. Sat. Sol.		Solid Phase.
K_2SO_4.	H_2SO_4.		K_2SO_4.	H_2SO_4.	
0.53	0.37	K_2SO_4	0.61	2.12	K_a+K_b
0.64	0.75	"	0.54	2.29	K_b
0.74	1.08	" $+K_3H(SO_4)_2$	0.53	2.30	" $+KHSO_4$
0.73	1.13	$K_3H(SO_4)_2$	0.43	2.48	$KHSO_4$
0.71	1.44	"	0.28	3.04	"
0.69	1.66	"	0.12	4.43	"
0.69	1.88	" $+K_a$	0.09	5.27	"

K_a and K_b are acid sulfates between $K_3H(SO_4)_2$ and $KHSO_4$. Their compositions were not determined.

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°.

(D'Ans, 1909a, 1913; see also Herz, 1911–12.)

Mols. per 1000 Gms. Sat. Sol.		Solid Phase.	Mols. per 1000 Gms. Sat. Sol.		Solid Phase.
K_2SO_4.	H_2SO_4.		K_2SO_4	$H_2SO_4+SO_3$	
1.27	1.31	$K_2SO_4+K_3H(SO_4)_2$	0.250	8.10	$KH_3(SO_4)_2.H_2O$
1.33	1.99	$K_3H(SO_4)_2+Ky$	0.352	8.15	"
1.24	2.03	Ky	0.364	8.16	" $+KH_3(SO_4)_2$
1.13	2.17	"	0.341	8.29	$KH_3(SO_4)_2$
1.04	2.35	" $+KHSO_4$	0.322	8.33	"
1.032	2.345	$KHSO_4$	0.325	8.45	"
0.67	2.83	"	0.346	6.62	"
0.22	4.13	"	0.384	8.57	"
0.15	5.36	"	0.412	8.71	"
			0.583	8.82	"
K_2SO_4.	$H_2SO_4+SO_3$.		0.880	8.65	" $+KHS_2O_7$
0.171	6.42	$KHSO_4$	0.899	8.63	KHS_2O_7 (unstable)
0.190	6.60	"	0.882	8.70	"
0.266	6.91	" $+KH_3(SO_4)_2.H_2O$	0.561	8.96	"
0.182	7.26		0.365	9.80	"
0.157	7.62		0.43	9.78	"
0.167	7.88		0.665	9.80	"
0.201	8		0.937	9.66	"

K_y = an acid sulfate between $K_3H(SO_4)_2$ and $KHSO_4$ of which the exact composition was not determined.

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS ALCOHOL.
(Gerardin, 1865; Schiff, 1861.)

In Aq. Alcohol of 0.939, Sp. Gr. = 40 Wt. %.

t°.	Gms. K_2SO_4 per 100 Gms. Alcohol.
40	0.16
80	0.21
60	0.92

In Alcohol of Different Strengths at 15°.

Weight per cent Alcohol.	Gms. K_2SO_4 per 100 Gms Sat Sol.
10	3.90
20	1.46
30	0.56
40	0.21

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS ALCOHOL AT 25°.
(Fox and Gauge, 1910.)

Gms. per 100 Gms. Sat. Solution.			Gms. per 100 Gms. Sat. Solution.		
K_2SO_4.	C_2H_5OH.	H_2O	K_2SO_4	C_2H_5OH	H_2O.
9.17	1.35	89.48	2.66	15.26	82.08
6.90	4.80	88.30	1.83	20.50	77.67
4.96	7.80	87.24	0.97	26.91	72.12
4.32	9.70	85.98	0.41	35.97	63.62
3.57	12.34	84.09	0.22	43.90	55.88
2.71	14.51	82.78	0.016	69.26	30.72

SOLUBILITY OF POTASSIUM SULFATE AT 25° (Fox and Gauge, 1910) IN:

Aqueous Chloral Hydrate Solutions.

Gms. per 100 Gms. Sat Solution.		
K_2SO_4.	$CCl_3CH(OH)_2$.	H_2O.
9.13	6.44	84.43
8.41	9.09	82.50
7.79	12.38	79.83
7.31	13.20	79.49
5.88	22.07	72.05
4.54	33.15	62.31
3.36	44.40	52.24
2.92	47.30	49.78
2	62.82	35.18
1.75	70.28	27.97
1.40	80.36	18.24
1.08	85.26	13.66

Aqueous Glycerol Solutions.

Gms. per 100 Gms. Sat Solution.		
K_2SO_4.	$(CH_2OH)_2CHOH$.	H_2O.
8.87	8.96	82.17
7.69	13.36	78.95
6.47	20.34	73.19
5.83	24.15	70.02
4.44	33.73	61.83
3.65	40.40	55.95
3.38	43.52	53.10
2.69	50.18	47.13
2.07	57.22	40.71
1.53	67.94	30.53
0.98	78.18	20.84
0.73	98.28	0.99

SOLUBILITY OF POTASSIUM SULFATE AT 25° (Fox and Gauge, 1910.) IN:

Aqueous Acetone Solutions.

Gms. per 100 Gms. Sat. Solution.		
K_2SO_4.	$(CH_3)_2CO$.	H_2O.
7.20	4.92	87.88
5.02	10.06	84.92
2.96	16.23	80.81
1.50	24.31	74.19
0.47	37.19	62.34
0.20	46.29	53.51
0.03	62.40	37.57

Aqueous Pyridine Solutions.

Gms per 100 Gms. Sat Solution.		
K_2SO_4.	$CH<(CH.CH)_2>N$.	H_2O.
7.95	4.23	87.82
4.77	13.90	81.33
2.75	24.51	72.74
1.47	34.19	64.34
0.45	46.29	53.26
0.12	55.93	43.95
0.006	75.90	24.09

SOLUBILITY OF POTASSIUM SULFATE AT 25° (Fox and Gauge, 1910.) IN:

Aqueous Ethylene Glycol Solutions.

Gms. per 100 Gms. Sat. Solution.		
K_2SO_4.	$(CH_2OH)_2$.	H_2O.
9.67	3.16	87.17
7.69	9.79	82.53
5.74	18.47	75.79
3.57	32.11	64.32
1.83	49.03	49.14

Aqueous Mannitol Solutions.

Gms. per 100 Gms. Sat. Solution.		
K_2SO_4.	$(CHOH)_4(CH_2OH)_2$.	H_2O.
10.32	3.20	86.48
9.61	8.35	82.04
9.19	11.26	79.55
8.66	14.30	77.04
8.35	17.22	74.43

SOLUBILITY OF POTASSIUM SULFATE AT 25° IN:

Aq. Sucrose Solutions.
(Fox and Gauge, 1910)

Gms. per 100 Gms Sat Solution.		
K_2SO_4.	$C_{12}H_{22}O_{11}$.	H_2O.
9.65	9.56	80.79
8.65	18.55	72.80
7.42	28.16	64.42
6.35	37.24	56.41
5.21	47.55	47.24
4.24	57	38.76

Aq. Potassium Acetate Solutions.
(Fox, 1909.)

Gms. per 100 Gms. Sat. Solution.		
K_2SO_4.	CH_3COOK.	H_2O.
6.65	6.11	87.24
5.09	8.68	86.23
3.99	11.29	84.72
2.35	15.59	82.06
1.23	20.12	78.65
0.39	29 95	69.66

100 gms. glycerol of $d = 1.255$ dissolve 1.316 gms. K_2SO_4 at ord. temp. (Vogel, 1867.)

SOLUBILITY OF POTASSIUM SULFATE IN AQUEOUS ACETIC ACID AND IN AQUEOUS PHENOL SOLUTIONS AT 25°.
(Rothmund and Wilsmore, 1902)

In Aq. Acetic Acid.

Mols. per Liter.		Grams per Liter.	
CH_3COOH.	K_2SO_4	CH_3COOH.	K_2SO_4.
0.0	0.6714	0.0	117.0
0.07	0.6619	4.2	115.4
0.137	0.6559	8 22	114.4
0.328	0.6350	19.68	110.8
0.578	0.6097	34.68	106.3
1.151	0.5556	69.06	96.87
2.183	0.4743	128.58	82.70

In Aq. Phenol.

Mols. per Liter		Grams per Liter.	
C_6H_5OH.	K_2SO_4	C_6H_5OH.	K_2SO_4.
0.0	0.6714	0 0	117.0
0.032	0.6598	3.01	115.0
0 064	0.6502	6.02	113.3
0 127	0.6310	11.94	110.0
0 236	0.6042	22.19	105.3
0 308	0.5834	28.97	101.7
0.409	0.5572	38.46	97.2
0.464	0.5480	43.63	95.5
0.498 (sat.)	0.5377	46.82	93.8

100 gms. water dissolve 10.4 gms. K_2SO_4 + 219 gms. sugar at 31.25°, or 100 gms. sat. solution contain 3.18 gms. K_2SO_4 + 66.74 gms. sugar. (Kohler, 1897.)

100 gms. 95% formic acid dissolve 36.5 gms. K_2SO_4 at 21°. (Aschan, 1913.)

100 gms. 95% formic acid dissolve 14.6 gms. $KHSO_4$ at 19.3°. "

100 cc. anhydrous hydrazine dissolve 5 gms. K_2SO_4 at room temp. (Welsh and Broderson, 1915.)

100 gms. hydroxylamine dissolve 3.5 gms. K_2SO_4 at 17–18°. (de Bruyn, 1892.)

FREEZING-POINT DATA (Solubility, see footnote, p. 1) ARE GIVEN FOR THE FOLLOWING MIXTURES:

$K_2SO_4 + K_2WO_4$.	(Amadori, 1913.)
" $+ Ag_2SO_4$.	(Nacken, 1907b.)
" $+ NaCl$.	(Sackur, 1911–12.)
" $+ Na_2SO_4$.	(Jaenecke, 1908; Nacken, 1907 (b) (c); Sackur, 1911–12).
" $+ SrSO_4$.	(Grahmann, 1913; Calcagni, 1912, 1912a.)

POTASSIUM BiSULFATE $KHSO_4$.

SOLUBILITY IN WATER.

(Kremers, 1854.)

t°.	0°.	20°.	40°.	100°.
Gms. $KHSO_4$ per 100 gms. H_2O	36.3	51.4	67.3	121.6

See also p. 560.

POTASSIUM PerSULFATE $K_2S_2O_8$.

SOLUBILITY IN WATER.

(Tarugi, 1904)

t°.	Gms. $K_2S_2O_8$ per 100 cc Sat. Sol.	t°.	Gms. $K_2S_2O_8$ per 100 cc. Sat Sol.	t°.	Gms. $K_2S_2O_8$ per 100 cc. Sat Sol.
0	1.620	15	3.140(3.7)	30	7.190(7.7)
5	2.156	20	4.490	35	8.540
10	2.600	25	5.840	40	9.890

The results in parentheses are the averages of a large number of determinations by Pajetta (1906). This investigator employed constant agitation for various lengths of time. Tarugi approached equilibrium from above as well as below but stirred the solutions only at intervals. The determination of the dissolved persulfate was made by boiling a measured volume of the clear saturated solution for 20 min. and titrating the H_2SO_4 liberated, according to the equation $K_2S_2O_8+H_2O = K_2SO_4 + H_2SO_4 + O$. Tarugi also reports that the presence of a number of sodium and other salts in solution, does not appreciably alter the solubility of $K_2S_2O_8$ in water.

100 gms. H_2O dissolve 1.77 gms. $K_2S_2O_8$ at 0°. (Marshall, 1891.)

SOLUBILITY OF POTASSIUM PERSULFATE IN SATURATED AQUEOUS SALT SOLUTIONS AT 12°.

(Pajetta, 1906)

(An excess of the salt and of $K_2S_2O_8$ was, in each case, added to water and the mixture stirred at constant temperature for 10 to 20 hours.)

Salt.	Gms $K_2S_2O_8$ per 100 Gms Sat Sol.	Salt.	Gms. $K_2S_2O_8$ per 100 Gms. Sat. Sol.
Water alone	3 196	K_2SO_4	0.798
$Na_2SO_4.10H_2O$	6.238	$KHSO_4$	0.336
$NaHSO_4$	8 842	KNO_3	0 904
$Na_2HPO_4.12H_2O$	4.766	K_2CO_3	0.0146
$Na_2B_4O_7.10H_2O$	3.825	$KHCO_3$	0.317
$NaNO_3$	19.302	$MgSO_4.7H_2O$	2.990
$Na_2CO_3.10H_2O$	5 682	$CaSO_4.2H_2O$	3.384
$NaHCO_3$	5.042		

Additional determinations made with salt solutions of lower concentrations than saturation, gave the following results at 12.5°.

Salt.	Gms. Salt per 100 Gms. H_2O.	Gms $K_2S_2O_8$ per 100 Gms. Sat Sol	Salt	Gms. Salt per 100 Gms. H_2O	Gms. $K_2S_2O_8$ per 100 Gms. Sat. Sol.
Na_2CO_3	2.304	4.297	$NaHSO_4$	5.218	4.556
$NaHCO_3$	3.652	4.230	$NaNO_3$	3.696	4.613
$Na_2SO_4.10H_2O$	7	4.554	Na_2HPO_4	3.086	4.446

POTASSIUM Ethyl **SULFATE** $K(C_2H_5)SO_4$.

SOLUBILITY IN WATER.

(Illingworth and Howard, 1884)

t°.	Gms. $K(C_2H_5)SO_4$ per 100 Gms. Sat. Sol.
−14.2	45.01
0	53.71
+15	62.35

SOLUBILITY OF POTASSIUM ETHYL SULFATE, POTASSIUM METHYL SULFATE AND OF POTASSIUM AMYL SULFATE IN WATER, DETERMINED BY THE FREEZING-POINT METHOD. (Illingworth and Howard, 1884.)

Results for $K(C_2H_5)SO_4 + H_2O$.

t°. of Solidification.	Gms. $K(C_2H_5)SO_4$ per 100 Gms. Sol.	Solid Phase.
− 2.2	10	Ice
− 4.9	20	"
− 8.2	30	"
−12.1	40	"
−14.2	45.01	" + $K(C_2H_5)SO_4$
− 6	50	$K(C_2H_5)SO_4$
0	53.71	"
+15	62.35	"

Results for $K(CH_3)SO_4 + H_2O$.

t° of Solidification.	Gms. $K(CH_3)SO_4$ per 100 Gms. Sol.	Solid Phase.
− 2.3	10	Ice
− 3.6	15	"
− 5	20	"
− 8	30	"
−11.8	39.84	" + $K(CH_3)SO_4$
−11.5	40	$K(CH_3)SO_4$
0	47.1	"
+12.3	54.8	"

Results for $K(C_5H_{11})SO_4 + H_2O$.

t° of Solidification.	Gms. $K(C_5H_{11})SO_4$ per 100 Gms. Sol.	Solid Phase.
− 1.9	10	Ice
− 4.3	20	"
− 5.4	24	"
− 4.8	25	+ $K(C_5H_{11})SO_4$ $K(C_5H_{11})SO_4$
0	33.44	"
+17.3	59.46	"

POTASSIUM Sodium SULFITE $KNa_2H(SO_3)_2.4H_2O$.

100 gms. H_2O dissolve 69 gms. of the salt at 15°. (Schwicker, 1889.)

POTASSIUM SULFONATES

SOLUBILITY IN WATER.

Salt.	t°.	Gms. Anhydrous Salt per 100 Gms. H_2O.	Authority.
Potassium Naphthalene Monosulfonate.½H_2O	25	8 48*	(Witt, 1915.)
" 2 Phenanthrene Monosulfonate.½H_2O	20	0 273	(Sandquist, 1912.)
" 3 " " .0H_2O	20	0.342	"
" 10 " " .1H_2O	20	0 84	"
" o Guaiacol Sulfonate (Thiocol)	15–20	16.6	(Squire & Caines, 1905.)

* $d = 1.029$

100 cc. 90 vol. % alcohol dissolve 0.25 gm. thiocol at 15°–20°. (Squire and Caines, 1905.)

POTASSIUM SULFIDE K_2S.

Fusion-point data for $K_2S + S$ are given by Thomas and Rule (1917).

POTASSIUM Antimony SULFIDE, see Potassium Sulfoantimonate, p. 500.

POTASSIUM TARTRATE $(K_2C_4H_4O_6)_2.H_2O$.

100 gms. H_2O dissolve 138 gms. $K_2C_4H_4O_6$ at 16.6°, Sp. Gr. of sat. sol. = 1.49. (Greenish and Smith, 1901.)

POTASSIUM (Bi) TARTRATE (Mono) $KHC_4H_4O_6$, Cream of Tartar.

SOLUBILITY OF MONO POTASSIUM TARTRATE IN WATER.

(Alluard, 1865; Roelofsen, 1894; Blarez, 1891; at 20°, Magnanini, 1901; at 25°, Noyes and Clement, 1894.)

t°.	Gms. $KHC_4H_4O_6$ per 100 Gms. Solution.		
0	0.30 (R.)	0.32 (A.)	0.35 (B.)
10	0.37	0.40	0.42
20	0.49	0.53 (M.)	0.60
25	0.58	0.654 (N. and C.)	0.74
30	0.69	0.9 (A.)	0.89
40	0.96	1.3	1.29
50	1.25	1.8	1.80
60	...	2.4	...
80	...	4.4	...
100	...	6.5	...

SOLUBILITY OF MONO POTASSIUM TARTRATE IN AQUEOUS ALCOHOL AT 25°.

(Seidell, 1910.)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $KHC_4H_4O_6$ per 100 Gms. Sat Sol.
0	1.002	0.649
10	0.985	0.358
20	0.970	0.210
30	0.953	0.131
40	0.933	0.087
50	0.912	0.064
60	0.890	0.043
80	0.842	0.023
92.3	0.807	0.014
100	0.789	0.010

SOLUBILITY OF MONO POTASSIUM TARTRATE IN AQUEOUS ALCOHOL AT 18°.

(Paul, 1917.)

Gms. C_2H_5OH per 100 cc. solvent	0	5	8	10
Gms. $KHC_4H_4O_6$ per liter sat. sol.	4.903	3.58	2.94	2.57

Approximate determinations at other temperatures are given by Roelofsen (1894) and by Wenger (1892).

SOLUBILITY OF MONO POTASSIUM TARTRATE ($KHC_4H_4O_6$) IN NORMAL SOLUTIONS OF ACIDS AT 20°.

(Ostwald, Huecke, 1884.)

Purified tartrate was added in excess to normal solutions of the acids, and, after shaking, clear 1 cc. portions of each solution were withdrawn and titrated with approximately 0.1 *n* $Ba(OH)_2$ solution; 1 cc. normal acid requiring 10.63 cc. of the $Ba(OH)_2$ solution.

Acid.	Gms. Acid per 100 cc. Solvent.	cc N/10 $Ba(OH)_2$ per 1 cc. Solution.	Gms. $KHC_4H_4O_6$ per 100 cc. Solution.	Acid.	Gms. Acid per 100 cc. Solvent.	cc. N/10 $Ba(OH)_2$ per 1 cc Solution.	Gms $KHC_4H_4O_6$ per 100 cc Solution.
HNO_3	6.31	5.77*	10.21	$C_2H_5SO_3H$	11.0	5.01*	8.87
HCl	3.65	5.32	9 42	$HO.(CH_2)_2SO_3H$	12.61	5 33	9.43
HBr	8.10	5.38	9.75	$C_6H_5SO_3H$	15 81	5.25	9.29
HI	12.80	5.43	9.61	HCOOH	4.60	0.45	0.80
H_2SO_4	4.90	3 97	7.03	CH_3COOH	6.00	0.27	0.48
HCH_3SO_4	11.21	5.58	12.44	$CH_2ClCOOH$	9.45	1.01	1.79
$HC_2H_5SO_4$	12.61	5.41	9.58	C_2H_5COOH	7.40	0.24	0.42
$HC_3H_7SO_4$	14.01	5.21	9.22	C_3H_7COOH	8.81	0.23	0.41

* The figures in this column show the amount of the $Ba(OH)_2$ solution in excess of that which would have been required by the normal acid solution alone in each case, viz., 10 63 cc. They, therefore, correspond to the amount of $KHC_4H_4O_6$ dissolved in 1 cc of each saturated solution, and when multiplied by 1.77 give the grams of $KHC_4H_4O_6$ per 100 cc. solution.

SOLUBILITY OF MONO POTASSIUM TARTRATE ($KHC_4H_4O_6$) IN AQUEOUS SOLUTIONS OF ELECTROLYTES AT 25°.

(Noyes and Clement, 1894; Magnanini, 1901.)

Electrolyte.	Gm. Equiv. per Liter		Gms per Liter		Electrolyte.	Gm. Equiv per Liter		Gms. per Liter	
	Electrolyte.	$KHC_4H_4O_6$	Electrolyte.	$KHC_4H_4O_6$.		Electrolyte	$KHC_4H_4O_6$.	Electrolyte	$KHC_4H_4O_6$
KCl	0.025	0 0254	1.86	4 788	CH_3COOK	0 05	0 0410	4 91	7 718
"	0.05	0.0196	3.73	3 680	"	0 10	0.0504	9 82	9.486
"	0.10	0 0133	7.46	2 509	"	0 20	0 0634	19.63	11 930
"	0.20	0 0087	14.92	1 636	$KHSO_4$(20°)	0 01	0 0375	1 36	7.06
$KClO_3$	0 025	0 0256	3 06	4 821	"	0.02	0 0500	2 72	9 41
"	0 05	0 0197	6.13	3 716	"	0 10	0.1597	13 62	30.06
"	0 10	0 0138	12.26	2 601	KHC_2O_4* (20°)	0 01	0 0369	1 28	6.94
"	0.20	0 0097	24.52	1 728	"	0 02	0 0424	2 56	7.98
KBr	0 05	0 0192	5.95	3 699	"	0.10	0 1132	12.82	21 30
"	0 10	0 0134	11.91	2 517	HCl	0.013	0 0367	0 45	6.90
"	0 20	0 0087	23 82	1 629	"	0.025	0 0428	0 91	8.06
KI	0 05	0.0196	8 30	3.687	"	0 050	0.0589	1 82	11.09
"	0.10	0 0132	16 61	2 492	NaCl	0 05	0.0376	2.92	7 08
"	0.20	0 0086	33.22	1 619	"	0.10	0.0397	5.85	7.48
KNO_3	0.05	0 0195	5.06	3 676	"	0 20	0 0428	11.70	8.05
"	0.10	0.0136	10 12	2 551	$NaClO_3$	0 05	0.0382	5.32	7.18
"	0.20	0.0090	20 24	1 696	"	0 10	0.0405	10.65	7.63
K_2SO_4	0.05	0.0208	4.36	3.921	"	0.20	0.0446	21.30	8.40
"	0.10	0.0147	8.72	2.769					
"	0.20	0.0100	17.44	1.888					

* = acid potassium oxalate.

POTASSIUM Sodium **TARTRATE.** $KNa.C_4H_4O_6.4H_2O$. (Rochelle or Seignette Salt.)

100 gms. sat. aq. solution contain 36.66 gms. $KNaC_4H_4O_6$ at 9.7° and 47.97 gms. at 29.5°. (van't Hoff and Goldschmidt, 1895.)

100 gms. H_2O dissolve 53.53 gms. $KNaC_4H_4O_6$ at 15°, Sp. Gr. of sol. = 1.2713. (Greenish & Smith, 1901.)

SOLUBILITY OF MIXTURES OF POTASSIUM TARTRATE AND OF SODIUM TARTRATE IN WATER AT SEVERAL TEMPERATURES.

(van Leeuwen, 1897.)

t°.	Gms. per 100 Gms Sat Sol. $K_2C_4H_4O_6$.	$Na_2C_4H_4O_6$.	Solid Phase.	t°.	Gms. per 100 Gms Sat. Sol. $K_2C_4H_4O_6$.	$Na_2C_4H_4O_6$.	Solid Phase.
18	19.2	16.5	$KNaC_4H_4O_6.4H_2O$	26.6	56	4.2	$KNaC_4H_4O_6.4H_2O+K_2T$
38	26.6	22.8	"	48.3	51.6	13.2	" "
20.9	11.8	28	" $+Na_2T$	59 7	44.5	25.3	K_2T+Na_2T
38	25.8	24.7	" "	80	39.7	34.7	" "
50	36.7	23.9	" "				

$K_2T = K_2C_4H_4O_6.\frac{1}{2}H_2O$. $Na_2T = Na_2C_4H_4O_6.2H_2O$.

SOLUBILITY OF SEVERAL POTASSIUM SALTS OF TARTARIC ACIDS IN WATER AT 20°.

(Schlossberg, 1900)

Salt.	Formula.	Gms. Salt per 100 Gms Sat Sol.
Potassium Sodium Salt of Racemic Acid	$KNa(C_4H_4O_6).3H_2O$	62.84
Potassium Sodium Salt of *d* Tartaric Acid	$KNa(C_4H_4O_6).4H_2O$	63.50
Potassium Neutral Inactive Pyrotartrate	$K_2C_5H_6O_6.H_2O$	56.33
Potassium Neutral Dextropyrotartrate	$K_2C_5H_6O_6$	57.62

SOLUBILITY OF POTASSIUM SODIUM TARTRATE IN AQ. ALCOHOL SOLUTIONS AT 25°.

(Seidell, 1910)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat Sol.	Gms. $KNaC_4H_4O_6.4H_2O$ per 100 Gms Solvent.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $KNaC_4H_4O_6.4H_2O$ per 100 Gms. Sat. Sol.
0	1.310	53.33	50	0 908	2.40
10	1.216	41.60	60	0.878	0.90
20	1.124	26.20	70	0 857	0.30
30	1.034	13.80	80	0 840	0.06
40	0.961	6	100	0.789	trace

POTASSIUM Dihydroxy**TARTRATES** $K_2C_4H_4O_8.H_2O$ and $KHC_4H_4O_8.H_2O$.

100 gms. H_2O dissolve 2.66 gms. $K_2C_4H_4O_8.H_2O$ at 0°. (Fenton, 1898.)
100 gms. H_2O dissolve 2.70 gms. $KHC_4H_4O_8.H_2O$ at 0°. "

F.-pt. data for mixtures of *d* and *l* dimethyl ester of potassium bitartrate and for mixtures of *d* and *l* diacetyl dimethylester of potassium bitartrate are given by Adriani (1900).

POTASSIUM TELLURATE K_2TeO_4.

100 gms. H_2O dissolve 8.82 gms. K_2TeO_4 at 0°, 27.53 gms. at 20° and 50.42 gms. at 30°. (Rosenheim and Weinheber, 1910–11.)

POTASSIUM THIOCYANATE KSCN.

SOLUBILITY IN WATER.

t°.	Gms. KSCN per 100 Gms. Sat. Sol.	Solid Phase.	Authority.
− 6.5	16.7	Ice	(Rüdorff, 1872.)
− 9.55	23.1	"	"
−31.2 Eutec.	50.25	" +KSCN	(Wassilijew, 1910.)
0	63.9	KSCN	
20	68.5	"	(Rüdorff, 1869.)
25	70.5	"	(Foote, 1903.)

SOLUBILITY OF MIXTURES OF POTASSIUM THIOCYANATE AND SILVER THIOCYANATE IN WATER AT 25°.

(Foote, 1903.)

Gms. per 100 Gms. Solution. KSCN.	Gms. per 100 Gms. Solution. AgSCN.	Mols per 100 Mols. H_2O. KSCN.	Mols per 100 Mols. H_2O. AgSCN.	Solid Phase.
70.53	...	44 36	...	KSCN
66.55	9.32	51.13	4.19	KSCN + 2KSCN AgSCN
64.47	10.62	47.98	4.60	Double Salt 2KSCN.AgSCN = 53 92% KSCN
61.25	11.76	42.07	4.72	"
58.34	13.55	38.47	5.23	"
53.21	17 53	33.71	6.50	"
50.68	20.43	32 52	7.67	2KSCN AgSCN + KSCN AgSCN
49.43	20.32	30.29	7.28	Double Salt. KSCN AgSCN = 36 9% KSCN
32.51	18.34	12.26	4 05	"
24.68	16 41	7.77	3.02	"
23.86	16.07	7.36	2.90	KSCN.AgSCN + AgSCN

SOLUBILITY OF POTASSIUM THIOCYANATE IN ACETONE, AMYL ALCOHOL, ETC.

(von Laszcynski, 1894.)

In Acetone. t°.	Gms. KSCN per 100 Gms. $(CH_3)_2CO$.	In Amyl Alcohol. t°.	Gms. KSCN per 100 Gms. $C_5H_{11}OH$.	In Ethyl Acetate. t°.	Gms KSCN per 100 Gms $CH_3COOC_2H_5$.	In Pyridine. t°.	Gms. KSCN per 100 Gms. C_5H_5N.
22	20.75	13	0.18	0	0.44	0	6 75
58	20.40	65	1.34	14	0.40	20	6.15
		100	2.14	79	0.20	58	4.97
		133.5	3.15			97	3.88
						115	3.21

SOLUBILITY OF POTASSIUM THIOCYANATE IN PYRIDINE, DETERMINED BY THE SYNTHETIC METHOD.

(Wagner and Zerner, 1911.)

t°.	Gms. KSCN per 100 Gms. Mixture.	Solid Phase.	t°.	Gms. KSCN per 100 Gms. Mixture.	Solid Phase.
−42	0	C_5H_5N	70–71	1.23	KSCN
−42.1	0.5	"	116–117	0.89	"
−42.4	1.33	"	172.7	at this temperature two liquid layers appear and do not become homogeneous up to 200°.	
−42.8	2.4	"			
−43.3 Eutec.	3.1	" +KSCN			
about +10	2.2	KSCN	173.8 m. pt.	100	KSCN

100 gms. anhydrous acetonitrile dissolve 11.31 gms. KSCN at 18°.

(Naumann and Schier, 1914.)

Fusion-point data for mixtures of KSCN + NaSCN and KSCN + RbSCN are given by Wrzesnewsky (1912).

POTASSIUM THIOSULFATE $K_2S_2O_3$.

SOLUBILITY IN WATER. (Jo, 1911, 1912.)

t°.	Gms. $K_2S_2O_3$ per 100 Gms. H_2O	Solid Phase.	t°.	Gms $K_2S_2O_3$ per 100 Gms. H_2O.	Solid Phase.
0	96.1	$K_2S_2O_3.2H_2O$	56.1	234.5	$K_2S_2O_3.H_2O+3K_2S_2O_3.H_2O$
17	150.5	$3K_2S_2O_3.5H_2O$	60	238.3	$3K_2S_2O_3.H_2O$
20	155.4	"	65	245.8	"
25	165	"	70	255.2	"
30	175.7	"	75	268	"
35	202.4	" $+K_2S_2O_3.H_2O$	78.3	292	" $+K_2S_2O_3$
40	204.7	$K_2S_2O_3.H_2O$	80	293.1	$K_2S_2O_3$
45	208.6	"	85	298.5	"
50	215.2	"	90	312	"
55	227.7	"			

POTASSIUM Sodium **THIOSULFATE** $KNaS_2O_3.2H_2O$.

100 gms. H_2O dissolve 213.7 gms. $KNaS_2O_3.2H_2O$ (*a*) at 15°. (Schwicker, 1889.)
100 gms. H_2O dissolve 205.3 gms. $KNaS_2O_3.2H_2O$ (*b*) at 15°. "

POTASSIUM Fluo**TITANATE** $K_2TiF_6.H_2O$.

SOLUBILITY IN WATER. (Marignac, 1866.)

t°.	0°.	3°.	6°.	10°	14°.	20°.
Gms. K_2TiF_6 per 100 gms. H_2O	0.55	0.67	0.77	0.91	1.04	1.28

POTASSIUM VANADATE $K_3V_5O_{14}.5H_2O$.

100 gms. H_2O dissolve 19.2 gms. at 17.5°. (Radan, 1889.)

POTASSIUM ZINC VANADATE $KZnV_5O_{14}.8H_2O$.

100 gms. H_2O dissolve 0.41 gm. of the salt (Radan).

PRASEODYMIUM CHLORIDE $PrCl_3$.

SOLUBILITY IN WATER, AQ. HYDROCHLORIC ACID AND IN PYRIDINE. (Matignon, 1906, 1909)

Solvent.	t°.	Sp Gr. Sat. Sol.	Gms per 100 Gms. Sat. Sol.
Water	13	1.687	50.96 $PrCl_3$
Aq. HCl	13	1.574	41.05 $PrCl_3$+7.25HCl
Pyridine	room temp.	...	2.1 $PrCl_3$

PRASEODYMIUM GLYCOLATE $Pr_2(C_2H_3O_3)_3$.

One liter water dissolves 3.578 gms. $Pr_2(C_2H_3O_3)_3$ at 20°. (Jantsch & Grünkraut, '12–13.)

PRASEODYMIUM MOLYBDATE $Pr_2(MoO_4)_3$.

One liter water dissolves 0.0152 gm. $Pr_2(MoO_4)_3$ at 23° and 0.0143 gms. at 75°. (Hitchcock, 1895.)

PRASEODYMIUM Double **NITRATES**

SOLUBILITY AT 16° IN CONC. HNO_3 OF $d_{\frac{16}{4}}$ = 1.325. (Jantsch, 1912.)

Salt.			Formula.	Gms. Hydrated Salt per 100 cc. Sat. Solution.
Praseodymium	Magnesium	Nitrate	$[Pr(NO_3)_6]_2Mg_3.24H_2O$	7.70
"	Nickel	"	" Ni_3 "	9.28
"	Cobalt	"	" Co_3 "	12.99
"	Zinc	"	" Zn_3 "	14.69
"	Manganese	"	" Mn_3 "	23.40

PRASEODYMIUM OXALATE $Pr_2(C_2O_4)_3.10H_2O$.

One liter H_2O dissolves 0.00074 gm. $Pr_2(C_2O_4)_3$ at 25°. (Rimbach and Schubert, 1909.)
100 gms. aq. 19.4% HNO_3 (d = 1.116) dissolve 1.16 gms. $Pr_2(C_2O_4)_3$ at 15°. (v. Scheele, 1899.)
100 gms. aq. 10.2% HNO_3 (d = 1.063) dissolve 0.50 gm. $Pr_2(C_2O_4)_3$ at 15°. (v. Scheele, 1899.)

PRASEODYMIUM Dimethyl **PHOSPHATE** $Pr_2[(CH_3)_2PO_4]_6$.

100 gms. H_2O dissolve 64.1 gm. $Pr_2[(CH_3)_2PO_4]_6$ at 25°. (Morgan and James, 1914.)

PRASEODYMIUM SULFATE $Pr_2(SO_4)_3$.

SOLUBILITY IN WATER. (Muthmann and Rölig, 1898.)

t°.	Gms. $Pr_2(SO_4)_3$ per 100 Gms. Solution.	Gms. $Pr_2(SO_4)_3$ per 100 Gms. Water.	Solid Phase.	t°.	Gms. $Pr_2(SO_4)_3$ per 100 Gms. Solution.	Gms. $Pr_2(SO_4)_3$ per 100 Gms. Water.	Solid Phase.
0	16.5	19.8	$Pr_2(SO_4)_3.8H_2O$	75	4.0	4.2	$Pr_2(SO_4)_3.8H_2O$
18	12.3	14.1	"	85	1.5	1.55	$Pr_2(SO_4)_3.8H_2O$ + $Pr_2(SO_4)_3.5H_2O$
35	9.4	10.4	"				
55	6 6	7.1	"	95	1.0	1.01	$Pr_2(SO_4)_3.5H_2O$

PRASEODYMIUM SULFONATES

SOLUBILITY IN WATER.

Praseodymium Salt of:	Formula.	Gms. Anhydrous Salt per 100 Gms. H_2O.	Authority.
Bromonitrobenzene Sulfonic Acid	$Pr(C_6H_3\,Br.NO_2.SO_3,1,4,2)_3.8H_2O$	6.08	(Katz & James, '13.)
Benzene Sulfonic Acid	$Pr(C_6H_5SO_3)_3\,9H_2O$	55 6	(Holmberg, 1907.)
m Nitrobenzene Sulfonic Acid	$Pr[C_6H_4(NO_2)SO_3]_3\,6H_2O$	33 9	"
m Chlorobenzene Sulfonic Acid	$Pr[C_6H_4Cl\,SO_3]_3\,9H_2O$	12 6	"
Chloronitrobenzene Sulfonic Acid	$Pr(C_6H_3\,SO_3\,NO_2\,Cl,1,3,6)_3.14H_2O$	25 9	"
α Naphthalene Sulfonic Acid	$Pr[C_{10}H_7SO_3]_3\,6H_2O$	6 1	"
1.5 Nitronaphthalene Sulfonic Acid	$Pr[C_{10}H_6(NO_2)SO_3]_3.\,6H_2O$	0 47	"
1.6 " "	" $.\,9H_2O$	0.18	"
1.7 " "	" $.11H_2O$	1.3	"

PRASEODYMIUM TUNGSTATE $Pr_2(WO_4)_3$.

One liter water dissolves 0.0438 gm. $Pr_2(WO_4)_3$ at 75°. (Hitchcock, 1895.)

PROPIONIC ACID C_2H_5COOH.

SOLUBILITY IN WATER, DETERMINED BY THE FREEZING-POINT METHOD.
(Faucon, 1910.)

t° of Solidif.	Gms. C_2H_5COOH per 100 Gms. Sol.	Solid Phase.	t° of Solidif.	Gms C_2H_5COOH per 100 Gms. Sol.	Solid Phase.
− 1.33	4.98	Ice	−17.2	73.48	Ice
− 2.60	10.11	"	−21	81.75	"
− 3.76	15	"	−29 10	86.85	"
− 6 10	25	"	−29 40	87.65	" + C_2H_5COOH
− 7.70	35.28	"	−28.30	89.12	C_2H_5COOH
− 9.20	45.20	"	−26.90	92.40	"
−10.80	55	"	−23.90	97.22	"
−14.20	65.88	"	−19.30	100	"

Additional data for this system are given by Tsakalatos (1914), Herz (1917) and Balló (1910). The last-named investigator also determined the composition of the solid phases and explains the abnormal freezing-point lowering on the basis of production of mix-crystals.

The ratio of distribution of propionic acid between water and benzene was found by King and Narracott (1909) to be 1:0.129 at room temperature.

DISTRIBUTION OF PROPIONIC ACID BETWEEN ETHER AND AQUEOUS SALT SOLUTIONS AT 18°. (de Kolossovsky, 1911.)

Aq. Salt Solution (2 Mols. per Liter). Salt.	Gms. Salt per 100 cc.	C_2H_5COOH per 100 cc. of: Aq. Layer (q).	Ether Layer (q').	$\frac{q}{q'}$.
Water alone		1.170	2.305	0.50
NaCl	11.69	0.762	2.543	0.30
$MgCl_2$	19.05	0.567	3.135	0.18
KNO_3	20.22	0.972	2.298	0.42
$KC_3H_5O_2$	22.43	1.324	2.406	0.55

β IodoPROPIONIC ACID $CH_2I.CH_2.COOH$.

One liter sat. solution in water contains 80 gms. CH_2ICH_2COOH at 25°. (Sidgwick, 1910.)

One liter sat. solution in 1 *n* aq. sodium β iodopropionate contains 126 gms. at 25°. (Sidgwick, 1910.)

β PhenylPROPIONIC ACID (Hydrocinnamic Acid) $CH_2(C_6H_5).CH_2COOH$.

SOLUBILITY IN WATER AND IN AQ. NORMAL SODIUM β PHENYLPROPIONATE. (Sidgwick, 1910)

Solvent.	Gms $CH_2(C_6H_5)CH_2COOH$ per Liter Solution at: 11°.	25°.
Water	4.80	7.5
1 *n* aq. $CH_2(C_6H_5)CH_2.COONa$	7.65	172.5 (liquid layers formed)

SOLUBILITY OF β PHENYLPROPIONIC ACID IN WATER AND IN ALCOHOLS. (Timofeiew, 1894.)

Alcohol.	t°.	Gms. $CH_2(C_6H_5)$-CH_2COOH per 100 Gms. Sat. Solution.	Alcohol.	t°.	Gms. $CH_2(C_6H_5)CH_2COOH$ per 100 Gms. Sat. Solution.
Water	19	0.7	Ethyl Alcohol	+19.6	77.2
Methyl Alcohol	−18.5	55.8	" "	20	78.8
" "	−16	57.6	Propyl Alcohol	−18.5	35
" "	0	66.9	" "	−16	39
" "	+19.6	82.8	" "	+19.6	73.4
" "	20	83.8	" "	20	73.9
Ethyl "	−18.5	46	Isobutyl Alcohol	19.6	67.3
" "	−16	48			

SOLUBILITY OF β PHENYLPROPIONIC ACID IN SEVERAL SOLVENTS. (Herz and Rathmann, 1913)

Solvent.	$CH_2(C_6H_5)CH_2COOH$ per Liter Mols.	Gms.	Solvent.	$CH_2(C_6H_5)CH_2COOH$ per Liter. Mols.	Gms.
Chloroform	5.444	817.2	Tetrachloro Ethylene	4.725	709.2
Carbon Tetrachloride	4.604	691.1	Tetrachloro Ethane	5.430	815.1
Trichloro Ethylene	5.140	771.6	Pentachloro Ethane	5.019	753.4

β Phenyl DibromoPROPIONIC ACID $C_2H_2Br_2(C_6H_5)COOH$.

100 cc. sat. sol. in carbon tetrachloride contain 0.124 gm. acid at 26°. (De Jong, 1909.)

100 cc. sat. sol. in petroleum ether contain 0.072 gm. acid at 26°. "

PhenylPROPIOLIC ACID $C_6H_5C:C\,COOH$.

SOLUBILITY IN SEVERAL SOLVENTS. (Herz and Rathmann, 1913.)

Solvent.	$C_6H_5C:C\,COOH$ per Liter. Mols.	Gms	Solvent.	$C_6H_5C·C.COOH$ per Liter. Mols.	Gms.
Chloroform	0.789	115.30	Tetrachloro Ethylene	0.324	47.34
Carbon Tetrachloride	0.227	33.16	Tetrachloro Ethane	0.718	104.90
Trichloro Ethylene	0.382	55.82	Pentachloro Ethane	0.410	59.91

PROPIONIC ALDEHYDE C_2H_5COH.

100 gms. H_2O dissolve 16 gms. aldehyde at 20°. (Vaubel, 1899.)

PROPIONITRILE C_2H_5CN.

SOLUBILITY IN WATER.

Synthetic method used. See Note, p. 16. (Rothmund, 1898.)

t°.	Wt. per cent C_2H_5CN in: Aq Layer.	C_2H_5CN Layer	t°.	Wt. per cent C_2H_5CN in: Aq. Layer.	C_2H_5CN Layer.
40	10.7	92.1	95	19.6	78.0
50	11.6	90.5	100	22.4	75.5
60	12.7	88.5	105	26.0	72.1
70	13.2	86.1	110	32.0	66.5
80	14.9	83.4	113.1 (crit. temp.)	48.3	
90	17.6	80.2			

PROPYL ACETATE, Butyrate and Propionate.

SOLUBILITY OF EACH IN AQUEOUS ALCOHOL MIXTURES.

(Bancroft — Phys. Rev. 3, 205, '95, calc. from Pfeiffer)

cc. Alcohol in Mixture.	cc. H_2O Added to Cause Separation * in: P Acetate.	P. Butyrate.	P. Propionate.	cc Alcohol in Mixture.	cc H_2O Added to cause Separation * in: P Acetate	P Butyrate.	P. Propionate.
3	4.50	1.19	1.58	21	58.71	19.68	27.83
6	10.48	3.55	4.70	24	∞	23.72	33.75
9	17.80	6.13	8.35	30		32.10	47.15
12	26.00	9.05	12.54	36		41.55	63.18
15	35.63	12.31	17.15	42		51.60	83.05
18	47.50	15.90	22.27	48		62.40	107.46
				54		73.85	...

* cc. H_2O added to cause the separation of a second phase in mixtures of the given amounts of alcohol and 3 cc. portions of propyl acetate, butyrate and propionate

SOLUBILITY OF PROPYL ACETATE, FORMATE, AND PROPIONATE IN WATER.

100 cc. H_2O dissolve 1.7 gms. propyl acetate at 22°. (Traube, 1884)
100 cc. H_2O dissolve 2.1 gms. propyl formate at 22°. "
100 cc. H_2O dissolve 0.6 cc. propyl propionate at 25°. (Bancroft, 1895.)

PROPYL ALCOHOL C_3H_7OH.

Freezing-point data (solubilities, see footnote, p. 1) for mixtures of propyl alcohol and water are given by Pickering (1893). Results for mixtures of iso-propyl alcohol and water are given by Dreyer (1913).

100 gms. sat. solution of propyl alcohol in liquid carbon dioxide contain 36.5 gms. C_3H_7OH at $-24°$ and 57.5 gms. at $-30°$. (Büchner, 1905–06.)

MISCIBILITY OF PROPYL ALCOHOL WITH MIXTURES OF CHLOROFORM AND WATER AT 0°.

(Bonner, 1910)

See Notes, pp. 14 and 287.

Composition of Homogeneous Mixtures. Gms. $CHCl_3$.	Gms. H_2O.	Gms. C_3H_7OH.	Sp Gr of Mixture.	Composition of Homogeneous Mixtures. Gms $CHCl_3$.	Gms H_2O.	Gms. C_3H_7OH.	Sp. Gr. of Mixture.
0.977	0.023	0.304	1.28	0.500	0.50	1.34	0.97
0.926	0.074	0.631	1.13	0.394	0.606	1.32	0.98
0.90	0.10	0.76	1.11	0.293	0.707	1.235	0.96
0.80	0.20	1.06	1.04	0.194	0.806	0.996	0.95
0.70	0.30	1.20	1.01	0.097	0.903	0.672	0.97
0.60	0.40	1.30	0.98	0.030	0.97	0.39	0.97

MISCIBILITY OF PROPYL ALCOHOL AT 0° WITH MIXTURES OF:

Carbon Tetrachloride and Water.
(Bonner, 1910.)

Composition of Homogeneous Mixtures.

Gms. CCl_4.	Gms H_2O.	Gms. C_3H_7OH.	Sp. Gr. of Mixture.
0.975	0.025	0.317	1.31
0.931	0.069	0.536	1.17
0.90	0.10	0.65	1.14
0.80	0.20	0.949	1.07
0.70	0.30	1.12	1.02
0.60	0.40	1.20	0.99
0.499	0.501	1.234	0.98
0.40	0.60	1.195	0.97
0.30	0.70	1.13	0.96
*0.25	0.75	1.06	...
0.194	0.806	0.912	0.96
0.100	0.90	0.68	0.96
0.013	0.987	0.354	0.96

Ethyl Bromide and Water.
(Bonner, 1910.)

Composition of Homogeneous Mixtures.

Gms. C_2H_5Br.	Gms. H_2O.	Gms. C_3H_7OH.	Sp. Gr. of Mixture.
0.941	0.039	0.367	1.21
0.912	0.088	0.615	1.11
0.90	0.10	0.64	1.10
0.80	0.20	0.85	1.05
0.70	0.30	1	1.02
0.60	0.40	1.09	1
0.491	0.509	1.124	0.98
0.40	0.60	1.10	0.97
0.30	0.70	0.90	0.96
0.20	0.80	0.81	0.96
0.14	0.86	0.671	0.96
0.10	0.90	0.56	0.97
*0.023	0.977	0.227	0.99

See Notes, pp. 14 and 287.

MISCIBILITY OF PROPYL ALCOHOL AT 0° WITH MIXTURES OF:

Bromobenzene and Water. (Bonner, 1910.)

Composition of Homogeneous Mixtures

Gms. C_6H_5Br.	Gms H_2O.	Gms C_3H_7OH.	Sp Gr of Mixture.
0.983	0.017	0.186	1.29
0.909	0.091	0.56	1.11
0.90	0.10	0.58	1.11
0.80	0.20	0.87	1.05
0.70	0.30	1.05	1.02
0.60	0.40	1.15	1
0.50	0.50	1.19	0.97
0.40	0.60	1.19	0.97
0.30	0.70	1.09	0.95
0.20	0.80	0.93	0.95
0.10	0.90	0.71	0.96
0.021	0.979	0.457	0.98

Bromotoluene and Water. (Bonner, 1910.)

Composition of Homogeneous Mixtures.

Gms $C_6H_4CH_3Br$.	Gms. H_2O.	Gms C_3H_7OH.	Sp Gr. of Mixture.
0.968	0.032	0.252	1.23
0.90	0.10	0.52	1.11
0.80	0.20	0.78	1.03
0.70	0.30	0.96	1.01
0.60	0.40	1.07	0.99
0.50	0.50	1.13	0.97
0.40	0.60	1.13	0.96
0.30	0.70	1.03	0.95
*0.25	0.75	0.97	...
0.20	0.80	0.90	0.94
0.10	0.90	0.72	0.95
0.013	0.987	0.424	0.96

See Notes, pp. 14 and 287.

DISTRIBUTION OF PROPYL ALCOHOL BETWEEN WATER AND COTTON-SEED OIL AT 25°.
(Wroth and Reid, 1916)

Gms. C_3H_7OH per 100 cc. Oil Layer	H_2O Layer.	Ratio.	Gms C_3H_7OH per 100 cc: Oil Layer.	H_2O Layer.	Ratio.
1.447	8.112	5.60	1.516	10.07	6.64
1.475	8.897	6.10	1.576	10.49	6.65
1.503	9.809	6.53	1.694	10.41	6.14

Data for systems composed of normal propyl alcohol, water and various inorganic salts are given by Timmermans, 1907.

PROPYLAMINE $CH_3.CH_2.CH_2.NH_2$.

The solubility of propylamine in water at 60°, determined by an aspiration method using an indifferent gas, is 191 when expressed in terms of the Bunsen absorption coefficient β (see p. 227) and l_{60} = 233 when expressed in terms of the Ostwald solubility expression. (Doyer, 1890.)

Freezing-point data for mixtures of propylamine and water, isopropylamine and water and for dipropylamine and water are given by Pickering (1893).

DISTRIBUTION OF PROPYLAMINES BETWEEN WATER AND TOLUENE.
(Moore and Winmill, 1912.)

Amine.	Results at 18°. Gm. Equiv. Amine per Liter of Aq. Layer.	Partition Coef.	Results at 25°. Gm Equiv. Amine per Liter of Aq. Layer.	Partition Coef.	Results at 32.35°. Gm. Equiv. Amine per Liter of Aq. Layer.	Partition Coef.
Propylamine	0.0973	5.434	0.03837	4.470	0.0602	3.311
"	0.0928	5.439	0.04300	4.470	0.0578	3.317
Dipropylamine	0.0764	0.1185	0.0722	0.0769	0.01168	0.05802
"	0.0794	0.1188	0.0681	0.0771	0.01199	0.05795
Tripropylamine	0.0003	0.003	...	...	...	...

PROPYLAMINE HYDROCHLORIDE α $NH_2(C_3H_7).HCl$.

100 gms. H_2O dissolve 278.2 gms. $NH_2(C_3H_7).HCl$ at 25°. (Peddle and Turner, 1913.)
100 gms. $CHCl_3$ dissolve 5.26 gms. $NH_2(C_3H_7).HCl$ at 25°. (Peddle and Turner, 1913.)

DiPROPYL AMINE HYDROCHLORIDE $NH(C_3H_7)_2.HCl$.

100 gms. H_2O dissolve 165.3 gms. $NH(C_3H_7)_2.HCl$ at 25°. (Peddle and Turner, 1913.)
100 gms. $CHCl_3$ dissolve 47.24 gms. $NH(C_3H_7)_2.HCl$ at 25°. (Peddle and Turner, 1913.)

PROPYL CHLORIDE, Bromide, etc.

SOLUBILITY IN WATER.
(Rex, 1906.)

Propyl Compound.	Grams P. Compound per 100 Gms. H_2O at: 0°.	10°.	20°.	30°.
$CH_3CH_2CH_2Cl$ (normal)	0.376	0.323	0.272	0.277
$CH_3CH_2CH_2Br$ "	0.298	0.263	0.245	0.247
$CH_3CH_2CH_2I$ "	0.114	0.103	0.107	0.103
$(CH_3)_2CHCl$ (iso)	0.440	0.363	0.305	0.304
$(CH_3)_2CHBr$ "	0.418	0.365	0.318	0.318
$(CH_3)_2CHI$ "	0.167	0.143	0.140	0.134

PROPYLENE C_3H_6.

SOLUBILITY IN WATER.
(Than, 1862.)

t°.	β.	q.
0	0.4465	0.0834
5	0.3493	0.06504
10	0.2796	0.0519
15	0.2366	0.0437
20	0.2205	0.0405

For values of β and q, see Ethane, p. 285.

PYRENE $C_{16}H_{10}$

SOLUBILITY IN TOLUENE AND IN ABSOLUTE ALCOHOL.

100 gms. toluene dissolve 16.54 gms. pyrene at 18°.
100 gms. absolute alcohol dissolve 1.37 gms. pyrene at 10° and 3.08 gms. at b. pt.

PYRIDINE CH < (CH.CH)$_2$ > N.

SOLUBILITY IN WATER, DETERMINED BY THE FREEZING-POINT METHOD.
(Average curve from results of Pickering (1893) and Baud (1909.)

t°. of Solidification.	Gms. C_5H_5N per 100 Gms. Mixture.	Solid Phase.	t° of Solidification.	Gms. C_5H_5N per 100 Gms. Mixture.	Solid Phase.	t° of Solidification.	Gms. C_5H_5N per 100 Gms. Mixture.	Solid Phase.
0	0	Ice	−10	58.5	Ice	−60	84	Ice
−1	7.5	"	−12.5	62	"	−65 Eutec.	85	" + C_5H_5N
−2	17	"	−15	64.5	"	−60	87	C_5H_5N
−3	28	"	−20	68	"	−55	89	"
−4	37.5	"	−25	71	"	−50	92	"
−5	43.5	"	−30	73.5	"	−45	95	"
−6	48	"	−40	78	"	−40	97	"
−8	54	"	−50	81.5	"	−38 m. pt.	100	"

Timmermans (1912) is reported to have made determinations on the above systems but the original paper could not be located.

Baud also gives data for the densities of pyridine + water mixtures.

DISTRIBUTION OF PYRIDINE BETWEEN WATER AND BENZENE.

At Room Temperature. (v. Georgievics, 1915) Gms. C_5H_5N per 25 cc. H_2O Layer.	75 cc C_6H_6 Layer.	At 25°. (Hantzsch and Sebaldt, 1899) Mols. C_5H_5N per Liter.	Aq. Layer	C_6H_6 Layer.	Ratio.
0.0617	0.4733		0.00148	0.00436	0.339
0.0958	0.7631		0.00076	0.00226	0.339
0.1549	1.2249		0.00038	0.00110	0.345
0.2432	2.0096		0.000208	0.000546	0.381
0.3297	2.6553		0.000112	0.000274	0.413
0.723	5.4159	(at 5.5°)	0.000456	0.000928	0.491
1.147	9.878	(at 50°)	0.000314	0.001088	0.289

DISTRIBUTION OF PYRIDINE BETWEEN WATER AND TOLUENE.
(Hantzsch and Vagt, 1901)

At 25°. Mols. C_5H_5N per Liter. Aq. Layer.	$C_6H_5CH_3$ Layer.	Ratio.	t°.	At Various Temperatures. Mols. C_5H_5N per Liter. Aq. Layer.	$C_6H_5CH_3$ Layer.	Ratio.
0.0517	0.1129	0.458	0	0.0168	0.0201	0.840
0.0261	0.0559	0.466	10	0.0135	0.0215	0.627
0.0132	0.0275	0.481	20	0.0111	0.0228	0.529
0.0067	0.0137	0.496	30	0.0108	0.0234	0.461
0.0033	0.0066	0.551	40	0.0101	0.0245	0.411
0.0019	0.0034	0.629	50	0.0096	0.0252	0.380
0.0011	0.0017	0.647	70	0.0085	0.0263	0.324
0.0007	0.0010	0.696	90	0.0082	0.0266	0.307

Data for systems composed of pyridine, water and various inorganic salts are given by Timmermans, 1907.

Methyl PYRIDINES

Data for the reciprocal solubility of 3 methyl pyridine (= β picoline) and water, 2.6 dimethyl pyridine (= 2.6 lutidine) and water, methyl pyridine (= γ picoline) zinc chloride and water, methyl pyridine zinc chloride and each of the following alcohols; methyl, ethyl, propyl, isobutyl, isoamyl, cetyl and methyl hexylcarbinol, determined by the synthetic method (see Note, p. 16), are given by Flaschner (1909). See also p. 262, for 2.4.6 trimethyl pyridine (collidine) and water.

PYRIDINAMINO SUCCINIC ACIDS.

100 gms. H_2O dissolve 1.67 gms. of the *d* compound, 1.64 gms of the *l* compound and 1.68 gms. of the *dl* compound at 18°. (Lutz, 1910.)

PYROCATECHOL *o* $C_6H_4(OH)_2$.

100 gms. H_2O dissolve 45.1 gms. $C_6H_4(OH)_2$ at 20°. (Vaubel, 1899.)
100 gms. pyridine dissolve an unlimited amount of $C_6H_4(OH)_2$ at 20°. (Dehn, 1917.)
100 gms. aq. 50% pyridine dissolve 101 + gms. of $C_6H_4(OH)_2$ at 20-25°. "
F.-pt. data for pyrocatechol + resorcinol are given by Jaeger (1907).

PYROGALLOL $C_6H_3(OH)_3$ 1, 2, 3.

SOLUBILITY IN WATER, ETC.
(U. S. P. VIII.)

100 gms. water dissolve 62.5 gms. $C_6H_3(OH)_3$ at 25°.
100 gms. alcohol dissolve 100 gms. $C_6H_3(OH)_3$ at 25°.
100 gms. ether dissolve 90.9 gms. $C_6H_3(OH)_3$ at 25°.

Dimethyl **PYRONE** $C_7H_8O_2$.

Freezing-point data for mixtures of dimethyl pyrone and each of the following compounds: salicylic acid, *o, m, p* and α toluic acids and trinitrotoluene are given by Kendall (1914a). Results for mixtures of dimethyl pyrone and sulfuric acid are given by Kendall and Carpenter (1914).

QUINHYDRONE $C_6H_4O_2.C_6H_4(OH)_2$.

Data for the solubility and dissociation of quinhydrone in water at 25° are given by Luther and Leubner (1912).

QUINIDINE $C_{20}H_{24}N_2O_2$. $?H_2O$.

SOLUBILITY IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. $C_{20}H_{24}N_2O_2$ per 100. Gms. Solvent.	Gms. $C_{20}H_{24}N_2O_2$ per 100. cc Solvent.	Authority.
Water	18-22	0 020	...	(Müller, 1903.)
Water	25	...	0.0145	(Schaefer, 1910.)
Ethyl Alcohol (95%)	20	4	...	(Wherry & Yanovsky, 1918.)
Ethyl Alcohol	25	...	2.22	(Schaefer, 1913.)
Methyl Alcohol	25	...	0.66	"
Benzene	25	...	1.19	"
Benzene	18-22	2.45	...	(Müller, 1903.)
Carbon Tetrachloride	18-22	0 557	...	"
Chloroform	18-22	100+	...	"
Chloroform	25	...	25	(Schaefer, 1913.)
Ether (d = 0.72)	18-22	0.78	...	(Müller, 1903.)
Ether sat. with H_2O	18-22	1 63	...	"
H_2O sat. with Ether	18-22	0 031	...	"
Ethyl Acetate	18-22	1.76	...	"
Pet. Ether (b. pt. 59°-64°)	18-22	0 024	...	"
1 vol. C_2H_5OH+4 vols. $CHCl_3$	25	...	33 3	(Schaefer, 1913.)
1 vol. C_2H_5OH+4 vols. C_6H_6	25	...	12 5	"
1 vol. CH_3OH+4 vols. $CHCl_3$	25	...	25	"
1 vol. CH_3OH+4 vols. C_6H_6	25	...	6.6	"

QUINIDINE SALTS

SOLUBILITY IN WATER AT 25°.
(Schaefer, 1910.)

Quinidine Salt.	Gms. Salt per 100 Gms. H_2O.	Quinidine Salt.	Gms. Salt per 100 Gms. H_2O.
Q. Hydrobromide	0.526	Q. Sulfate	1.05
Q. Hydrochloride	1.160	Q. Tannate	0.0477
Q. Hydroiodide	0.082	Q. Tartrate	2.86
Q. Salicylate	0.060	Q. Bitartrate	0.323

SOLUBILITY OF QUINIDINE SULFATE IN SEVERAL SOLVENTS AT 25°.

(Schaefer, 1913.)

Solvent.	Gms. Q. Sulfate per 100 cc. Solvent.	Solvent.	Gms. Q. Sulfate per 100 cc. Solvent.
Ethyl Alcohol	5	1 vol. C_2H_5OH+4 vols. $CHCl_3$	33.3
Methyl Alcohol	40	1 vol. C_2H_5OH+4 vols. C_6H_6	8.33
Chloroform	8.33	1 vol. CH_3OH+4 vols. $CHCl_3$	33.3
Benzene	Insol.	1 vol. CH_3OH+4 vols. C_6H_6	20

QUININE $C_{20}H_{24}N_2O_2.3H_2O$.

SOLUBILITY IN SEVERAL SOLVENTS.

Solvent.	t°.	Anhydrous Quinine Gms. per 100. Gms. Solvent.	Anhydrous Quinine Gms. per 100. cc. Solvent.	Hydrated Quinine Gms. per 100 Gms. Solvent.	Authority.
Water	18–22	0.051	...	0.0574	(Müller, 1903.)
"	25	0.057	0.033	0.065	(U. S. P.; Schaefer, 1910.)
"	80	0.123	...	0.129	(U. S. P.)
Ethyl Alcohol	20	100	...	...	(Wherry and Yanovsky, 1918.)
" "	25	166.6	...	166.6	(U. S. P.)
" "	25	...	1333	...	(Schaefer, 1913.)
Methyl Alcohol	20	...	66.6	...	"
Benzene	25	...	0.55	0.205	(Schaefer; Müller, 1903.)
"	20	0.5	...	...	(Wherry and Yanovsky, 1918.)
"	18–22	1.7	...	...	(Muller, 1903.)
Aniline	20	14.5	...	...	(Scholtz, 1912.)
Carbon Tetrachloride	20	0.54	...	0.204	(Gori, 1913; Müller, 1903.)
Chloroform	25	50–52.6	...	62.5	(Schaefer, 1913; U. S. P.)
"	18–22	100+	...	100+	(Müller, 1903.)
Diethylamine	20	57	...	..	(Scholtz, 1912.)
Ether	25	22.2	...	76.9	(U. S. P.)
" (d=0.72)	18–22	0.876	...	1.62	(Muller, 1903.)
" sat. with H_2O	18–22	2.8	...	5.62	"
H_2O sat. with Ether	18–22	0.085	...	0.067	"
Ethyl Acetate	18–22	24.7	...	4.65	"
Petroleum Ether (b. pt. 59°–64°)	18–28	0.021	...	0.010	"
Oil of Sesame	20	...	0.0453	0.053	(Zalai, 1910.)
Glycerol	25	0.633	...	0.472	(U. S. P.; Ossendowski, 1907.)
Piperidine	20	119	...	...	(Scholtz, 1912.)
Pyridine	20	101	...	...	"
Aq. 50% Pyridine	20–25	59.4	...	...	(Dehn, 1917.)
7.65 gms. H_3BO_3 per 100 cc. aq. 50% Glycerol	room temp.	20	...	...	(Baroni and Barlinetto, 1911.)
15.3 gms. H_3BO_3 per 100 cc. aq. 50% Glycerol	room temp.	40	...	...	"

SOLUBILITY OF QUININE IN BENZENE, DETERMINED BY THE SYNTHETIC (SEALED TUBE) METHOD.

(van Iterson-Rotgans, 1914.)

t°.	Wt. % Quinine.	Solid Phase.	t°.	Wt. % Quinine.	Solid Phase.	t°.	Wt. % Quinine.	Solid Phase.
5.4	0	C_6H_6	53.5	4.81		137	80	$C_{20}H_{24}N_2O_2$
5.3*	...	" +	63	6.09	Mixed phase,	142	83.04	"
17	0.72	$C_{20}H_{24}N_2O_2.C_6H_6$	91	30.01	probably a	146	85.26	"
29	1.48	"	102	43.4	colloid or sol-	152	87.44	"
38.5	2.36	"	104.5	45.9	ution of high	158.5	91.4	"
49	5.22	" unstable	109	51.8	viscosity.	166	95.02	"
±70	28.9	" "	130	75.46		174.7	100	"

* Eutec.

Solubility of Quinine in Aqueous Solutions of Caustic Alkalies.

(Doumer and Deraux, 1895.)

Method. — A one per cent solution of quinine sulfate, containing a very small amount of HCl, was gradually added to 200 cc. portions of the caustic alkali solutions of the various concentrations stated, and the point noted at which a precipitate of the appearance corresponding to that of 1 cc. of milk in 100 cc. of water, remained undissolved.

In Aq. Ammonia.		In Aq. Sodium Hydroxide.		In Aq. Pot. Hydroxide.	
Gms. NH_3 per 200 cc. Solution.	Gms. Anhydrous Quinine Dissolved.	Gms. NaOH per 200 cc. Solution.	Gms. Anhydrous Quinine Dissolved.	Gms. KOH per 200 cc Solution.	Gms Anhydrous Quinine Dissolved.
0.52	0 084	0 007	0.092	0.612	0 088
0.65	0 084	0.012	0 091	1.512	0 082
4.59	0.096	0 740	0.090	3.456	0 068
13.08	0 122	2.160	0 079	10.944	0 039
18.88	0.144	3.188	0 056	44.704	0.006
25.19	0.174	6 172	0 044		
35.79	0.184	8 537	0 021		
		17 074	0.015		

Solubility of Quinine Salts in Water.

(Regnault and Willejean, 1887.)

Salt.	t°.	Gms Salt per 100 Gms H_2O.	Salt.	t°.	Gms. Salt per 100 Gms H_2O.
Brom Hydrate (basic)	14	2 06	Salicylate (basic)	15	0 114
" (neutral)	12	12 33	Sulfate "	14	0.139
" "	14	13.19	" "	16	0.153
" "	16	14 79	" "	18	0.160
" "	15	14 20	" (neutral)	15	8.50
Chlor Hydrate (basic)	12	3 80	" "	17	8.90
" "	14	4 14	" "	18	9.62
" "	15	4 25	Valerate (basic)	12–16	2.59
Lactate (basic)	15	10 03			
" "	37	16.18			

Solubility of Quinine Salts in Water at 25°.

(Schaefer, 1910)

Salt.	Gms Salt per 100 Gms H_2O.	Salt	Gms. Salt per 100 Gms. H_2O.
Acetate	2	Hypophosphite	2 85
Anisol	0 042	Lactate, basic	16 6
Arsenate	0 154	Nitrate	1 43
Benzoate	0 278	Oxalate	0 071
Bihydrobromide	20	Phosphate	0.125
Bihydrochloride	143 (133)	Picrate	0 029
Bihydrochloride + Urea	100	Quinate	28 6
Bisulfate	11 78	Salicylate	0 048
Chlorhydrosulfate	77 (50)	Sulfate	0 143
Chromate	0 032	Bisulfoguiacolate	200
Citrate	0 121 (0 083)	Sulfophenate	0.4
Glycerophosphate, basic	0.1178 (insol.)	Urate	0 182
Hydrobromide	2.33	Phenylsulfate	0 147
Hydrochloride	4.76	Tartrate	0.105
Hydroferrocyanide	0.05	Tannate	0.05(*)
Hydroiodide	0.49	Valerate	1.25

* Insol.

It is pointed out that different values for the solubility may be obtained depending on the method used for preparing the saturated solution.

Results in parentheses are by Squire and Caines (1905), and are for 15°–20° instead of 25°.

SOLUBILITY OF QUININE SALTS IN SEVERAL SOLVENTS.
(Phelps and Palmer, 1917.)

Salt.	M. pt. (uncorr)	Solubility, Parts per 100 Parts Solvent in: CCl_4.	$CHCl_3$. (Alcohol free).	Ethyl Acetate (Alcohol free). Cold.	Hot.
Quinine racemic lactate	165.5	0.00715	28.6	0.286	3.33
" *d* lactate	175	0.0111	...	0.25	...
" *l* "	171	0.00476	...	0.20	...
" formate	110–113	0.00625	...	...	...
" acetate	124–126	0.05	...	...	...
" propionate	110–111	0.238	...	...	...
" butyrate	77.5	4	...	...	...
" succinate	192	0.001	...	...	0.4
" tartrate	202.5	0 0004	...	...	0.0333
" malate	177.5	0 0008	...	...	0.5
" citrate	183.5	0.00167	...	...	0.0833
" sulfate	214	0 0025	0.0333	0.00715	0 0133
Quintoxime lactate	...	0 11	...	...	...

Saturation was obtained by shaking at intervals by hand, during 72 hours. In case of the determination at "hot," the solutions were boiled under a reflux condenser for 18 hours.

QUININE HYDROCHLORIDE $C_{20}H_{24}N_2O_2.HCl.2H_2O$.

SOLUBILITY IN AQUEOUS SALT SOLUTIONS AT 16°.
(Tarugi, 1914)

The determinations were made by adding an aqueous solution of quinine hydrochloride to the aqueous salt solution until turbidity occurred. From the volumes involved, the solubility per 100 cc. was calculated.

In Aq. NaCl. Gms per 100 cc Sol. NaCl	Q HCl	In Aq. $NaNO_3$. Gms per 100 cc Sol. $NaNO_3$	Q HCl	In Aq. KCl. Gms per 100 cc Sol KCl	Q HCl	In Aq. $CaCl_2$. Gms per 100 cc Sol. $CaCl_2$.	Q HCl
2 02	2.6	0 677	2 85	2.63	2 545	6 37	1.028
2.49	1.94	0 970	1 96	3	1 882	7 03	0 951
3.40	1.22	2 008	0 67	5.57	0 804	7.75	0 879
8.34	0.54	3 65	0.43	8 26	0.531	7.96	0.765
11 40	0 205	9 31	0 292	10 42	0 407	34 42	0.183
15.56	0.140	19 12	0.168	17 87	0.205		
19.83	0 085	31 78	0.0663	25.74	0.0997		

100 cc. 90% alcohol dissolve 20 gms. Q. bihydrochloride at 15°-20°. (Squire and Caines, 1905.)
" chloroform " 14.3 " " " "
" 90% alcohol " 14.3 " Q. hydrochlorosulfate at 15°-20°.
" " " " 0.5 " Q. glycerophosphate at 15°-20°.

100 gms. H_2O dissolve 1.3 gms. anhydrous Q. glycerophosphate at 100°.
(Rogier and Fiore, 1913.)

QUININE SALICYLATE $C_{20}H_{24}N_2O_2.C_6H_4(OH)COOH.2H_2O$.

SOLUBILITY IN AQUEOUS ALCOHOL AT 25°.
(Seidell, 1909, 1910)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms Q. Sal. $2H_2O$ per 100 Gms Sat Sol	Wt % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. Q. Sal. $2H_2O$ per 100 Gms. Sat. Sol.
0	0.999	0.065	60	0 896	2.45
10	0.982	0 080	70	0 876	3.25
20	0.966	0 200	80	0 854	4.20
30	0.952	0.48	90	0 832	4.71
40	0.935	1	92.3	0.826	4.62
50	0.916	1.70	100	0.797	3.15

SOLUBILITY OF QUININE SULFATE IN SEVERAL SOLVENTS AT 25°.
(Schaefer, 1913.)

Solvent.	Gms. Q. Sulfate per 100 cc. Solvent.	Solvent.	Gms. Q. Sulfate per 100 cc. Solvent.
Ethyl Alcohol	0.4	1 vol. C_2H_5OH+4 vols. $CHCl_3$	12.5
Methyl Alcohol	3.12	1 vol. C_2H_5OH+4 vols. C_6H_6	0 53
Chloroform	0.27	1 vol. CH_3OH+4 vols. $CHCl_3$	20
Benzene	insol.	1 vol. CH_3OH+4 vols. C_6H_6	4.76

100 gms. trichlorethylene dissolve 0.07 gm. Q. sulfate at 15°. (Wester and Bruins, 1914.)

QUININE TANNATES True and False

SOLUBILITY IN WATER AND IN AQUEOUS HCl AT 37°. (Muraro, 1908.)

Tannate.	Formula.	Gms Q. Tannate per 100 Gms. H_2O.	Aq. 1% HCl.	Aq. 3% HCl.
True Tannate I	$C_{20}H_{24}N_2O_2.C_{10}H_{14}O_9.4H_2O$	0	0.984	3.656
True Tannate II	$(C_{20}H_{24}N_2O_2)_2.(C_{10}H_{14}O_9)_3.8H_2O$	0	1.210	4.756
False Tannate	$(C_{20}H_{24}N_2O_2.H_2SO_4)_2(C_{10}H_{14}O_9)_5.14H_2O$	0.313	0.847	1.560

The work of Muraro is criticized by Biginelli (1908).
100 cc. 90% alcohol dissolve 33.3 gms. Q. tannate at 15°–20°. (Squire and Caines, 1905.)

QUININE PYROTARTRATES *l*, *i*, *d*.

SOLUBILITIES IN ALCOHOL AT 18°. (Ladenburg and Herz, 1898)

100 gms. alcohol dissolve 15 gms. of the *l* pyrotartrate, 3.2 gms. of the *i* and 4.2 gms of the *d* compound. The results show that the *i* acid is not a mixture of *d* and *l* acid, and, therefore, that the *i* quinine compound is a salt of the racemic acid.

SOLUBILITY OF QUININE AND OF QUININE SALTS IN WATER AND OTHER SOLVENTS. (U. S. P. VIII)

Compound.	Gms Quinine Compound per 100 Gms. Solvent in: Water At 25°	Water At 80°.	Alcohol. At 25°.	Ether. At 25°.	Chloroform. At 25°.	Glycerol. At 25°.
$C_{20}H_{24}N_2O_2$	0 057	0 123	166.6	22.2	52.6	0.633
$C_{20}H_{24}N_2O_2.3H_2O$	0.065	0 129	166 6	76 9	62 5	0 472
$C_{20}H_{24}N_2O_2HCl.2H_2O$	5.55	250	166.6	0.417	122	12.2
$C_{20}H_{24}.N_2O_2.C_6H_4(OH).$-$COOH.\frac{1}{2}H_2O$	1.30	2 86	9.09	0.91	2.70	6.25
$(C_{20}H_{24}N_2O_2)_2.H_2SO_4.7H_2O$	0 139	2.22	1 16	...	0 25	2.78
$C_{20}H_{24}N_2O_2.H_2SO_4.7H_2O$	11.77	147	5 55	0 056	0.109	5 55
$C_{20}H_{24}N_2O_2.HBr.H_2O$	2 5	33 3	149.2	6.2	...	12 5

QUINOLINE ETHIODIDE $C_9H_7N.C_2H_5I$.

100 gms. H_2O dissolve 301.3 gms. $C_9H_7N.C_2H_5I$ at 25°. (Peddle and Turner, 1913)
100 gms. $CHCl_3$ dissolve 1.78 gms. $C_9H_7N.C_2H_5I$ at 25°. "

RADIUM EMANATIONS

SOLUBILITY IN WATER. (Boyle, 1911; Kofler, 1913.)

t°.	Solubility. *l* (Boyle).	α (Kofler).	t°.	Solubility. *l* (Boyle).	α (Kofler).
0	0.508	0 54	30	0.195	0.205
5	0 41	0 442	40	0.16	0.165
10	0 34	0.37	50	...	0 14
15	0 29	0.31	60	...	0.12
20	0.245	0 265	70	...	0.11
25	0.215	0.232	90	...	0 108

The results of Boyle are in terms of *l*, the Ostwald Solubility Expression (see p. 227). Those of Kofler are in terms of the expression $\alpha = \frac{V - v}{v} \cdot \frac{E'}{E}$, where V and v are the volumes involved and E' and E the total amount of emanation contained respectively in the air and in the liquid.

SOLUBILITY IN SEVERAL SOLVENTS.
(Ramstedt, 1911; Swinne, 1913.)

Solvent.	Results at 0°.		Results at 18°.		Results at 14°. (Boyle, 1911.)
	l_0.	Sp. Gr. of Sol.	l_{18}.	Sp. Gr. of Sol.	l_{14}
Water	0.52	0.9999	0.285	0.9986	0.30
Sea Water	...	...	...	...	0.255
Ethyl Alcohol	8.28	0.8065	6.17	0.7911	7.34
Amyl Alcohol	...	...	...	...	9.31
Acetone	7.99	0.8186	6.30	0.7972	...
Aniline	4.43	1.0379	3.80	1.0210	...
Benzene	...	...	12.82	0.8811	...
Carbon Disulfide	33.4	1.2921	23.14	1.2640	...
Chloroform	20.5	1.5264	15.08	1.4907	...
Cyclohexane	...	...	18.04	0.7306	...
Ethyl Acetate	9.41	0.9244	7.34	0.9029	...
Ethyl Ether	20.9	0.7362	15.08	0.7158	...
Glycerol	...	...	0.21	1.262	...
Hexane	23.4	0.6769	16.56	0.6612	...
Toluene	18.4	0.8842	13.24	0.8666	13.7

The above results are in terms of the Ostwald Solubility Expression (see p. 227).

RESORCINOL $C_6H_4(OH)_2$ 1, 3.

SOLUBILITY IN:

t°.	Water. (Speyers — Am. J. Sci. [4] 14, 294, '02.) Sp. Gr of Solutions.	Gms $C_6H_4(OH)_2$ per 100 Gms. Water.	Solution.	Ethyl Alcohol. (Speyers) Sp Gr. of Solutions.	Gms. $C_6H_4(OH)_2$ per 100 Gms. Alcohol	Solution.
0	1.101	60	37.5	1.033	210	67.8
10	1.118	81	44.8	1.036	223	69.0
20	1.134	103	50.7	1.041	236	70.3
25	1.142	117	53.9	1.045	243	70.8
30	1.148	131	56.7	1.048	250	71.4
40	1.157	161	58.9	1.056	266	72.7
50	1.165	198	66.5	1.065	286	74.1
60	1.172	246	71.1	1.075	311	75.7
70	1.176	320	76.2	1.087	341	77.3
80	1.179	487	82.9	1.104	375	78.9

NOTE. — The original results of Speyers are given in terms of mols. per 100 mols. H_2O.

According to Vaubel (1895), 100 gms. H_2O dissolve 175.5 gms. $C_6H_4(OH)_2$, or 100 gms. sat. solution contain 63.7 gms. at 20°. Sp. Gr. of sol. = 1.1335.

SOLUBILITY OF RESORCINOL IN ALCOHOLS AND IN ACIDS.
(Timofeiew, 1894.)

Solvent.	t°.	Gms. $C_6H_4(OH)_2$ m per 100 Gms. Sat. Sol.	Solvent.	t°.	Gms. $C_6H_4(OH)_2$ m per 100 Gms. Sat. Sol.
Methyl Alcohol	11.6	69	Formic Acid	15	29.2
Ethyl "	10.4	59.2	Acetic "	15	32.5
" "	11.6	61.5	Propionic "	15	22.8
Propyl "	10.4	51.5	Butyric "	15	14.7
" "	11.6	51.6	Isobutyric "	15	9.6
			Valeric "	15	6.5

SOLUBILITY OF RESORCINOL IN BENZENE.

(Rothmund, 1898.)

t°.	Gms. $C_6H_4(OH)_2$ per 100 Gms Sat. Sol.	t°.	Gms. $C_6H_4(OH)_2$ per 100 Gms. Sat. Sol.
73	3.18	95.5	61.7
77	4.75	96.5	77.64
82	6.94	83.46	98.5
95.5	37.44	90.23	100

Between the concentrations 37.44 and 61.7 at 95.5° two liquid layers are formed. The reciprocal solubilities of these two layers, determined by the synthetic method (see Note, p. 16), are as follows:

t°.	Gms. $C_6H_4(OH)_2$ per 100 Gms. C_6H_6 Layer.	$C_6H_4(OH)_2$ Layer.	t°.	Gms. $C_6H_4(OH)_2$ per 100 Gms. C_6H_6 Layer.	$C_6H_4(OH)_2$ Layer.
60	4.8	79.4	90	13	71.3
70	6.6	77.5	100	19.5	65.7
80	9.2	75	105	24.6	60.7
			109.3 crit. temp.	42.4	

Resorcinol mixes with pyridine in all proportions. (Dehn, 1917.)
100 gms. aqueous 50% pyridine dissolve 901 gms. $C_6H_4(OH)_2$ *m* at 20°-25°. "
100 cc. olive oil dissolve 4.55 gms. $C_6H_4(OH)_2$ *m* at 15°-20°. (Squire and Caines, 1905.)
The coefficient of distribution of resorcinol at 25° between olive oil and water (conc. in oil ÷ conc. in H_2O) is given as 0.04 by Boeseken and Waterman (1911, 1912).

Freezing-point data (solubility, see footnote, p. 1), for mixtures of resorcinol and *p* toluidine are given by Philip and Smith (1905) and by Vignon (1891). Results for mixtures of resorcinol and *m* xylene are given by Campetti (1917).

DISTRIBUTION OF RESORCINOL BETWEEN WATER AND ORGANIC SOLVENTS AT ORDINARY TEMPERATURE.

(Vaubel — J. pr. Ch. [2] 67, 478, '03.)

Gms. $C_6H_4(OH)_2$ Used.	Solvents.	Gms $C_6H_4(OH)$ in: H_2O Layer.	Organic Solvent Layer.
1 191	60 cc. H_2O + 30 cc. Ether	0.2014	0 9896
1 191	60 cc. H_2O + 60 cc. Ether	0.2475	0 9525
0 800	40 cc. H_2O + 40 cc. Benzene	0.5873	0 2127
0.800	40 cc. H_2O + 80 cc. Benzene	0 5773	0 2227
0.500	50 cc. H_2O + 50 cc. CCl_4	0 4885	0.0115
0 500	50 cc. H_2O + 100 cc. CCl_4	0 4880	0 0120
0.500	50 cc. H_2O + 150 cc. CCl_4	0.4880	0.0120

RHODIUM SALTS. SOLUBILITY IN WATER.

(Jorgensen — J. pr. Ch. [2] 27, 433, '83, 34, 394, '86; 44, 51, '91.)

Salt.	Formula.	t°.	Gms. per 100 Gms. H_2O.
Chloro Purpureo Rhodium Chloride	$ClRh(NH_3)_5Cl_2$	17	0.56
Luteo Rhodium Chloride	$Rh(NH_3)_6Cl_3$	8	13.3
Luteo Rhodium Nitrate	$Rh(NH_3)_6(NO_3)_3$	ord. t	2.1
Luteo Rhodium Sulphate	$[Rh(NH_3)_6]_2(SO_4)_3.5H_2O$	20	2.3

ROSANILINE $C_{20}H_{21}N_3O$.

100 gms. H_2O dissolve 0.03 gm. $C_{20}H_{21}N_3O_4$ at 20°-25°. (Dehn, 1917.)
100 gms. pyridine dissolve 41.5 gms. $C_{20}H_{21}N_3O_4$ at 20°-25°. "
100 gms. aq. 50% pyridine dissolve 35.1 gms. $C_{20}H_{21}N_3O_4$ at 20°-25°. "

Triphenyl *p* **ROSANILINE HYDROCHLORIDE** $(C_6H_4.NH.C_6H_5)_3C(OH).HCl$.

SOLUBILITY IN SEVERAL SOLVENTS AT 23°.
(v. Szathmary de Szachmar, 1910.)

Solvent.	Gms. Triphenyl *p* Rosaniline HCl per 100 Gms Sat. Sol.
Methyl Alcohol	0.447
Ethyl "	0.285
Amyl "	0.11
Acetone	0.19
Aniline	0.518

ROSOLIC ACID $C_{20}H_{16}O_3$.

100 gms. H_2O dissolve 0.12 gm. $C_{20}H_{16}O_3$ at 20°–25°. (Dehn, 1917.)
100 gms. pyridine dissolve 160 gm. $C_{20}H_{16}O_3$ at 20°–25°. "
100 gms. aq. 50% pyridine dissolve 80 gm. $C_{20}H_{16}O_3$ at 20°–25°. "

RUBIDIUM ALUMS. See also Alums, p. 32.

SOLUBILITY IN WATER.
(Locke, 1901)

Alum.	Formula.	t°.	Gms. Alum per 100 Gms. H_2O. Anhydrous.	Hydrated.	G. Mols.
Rb. Aluminum Alum	$RbAl(SO_4)_2.12H_2O$	25	1 81	3 15	0.0059
"	"	30	2 19	...	0.0072
"	"	35	2 66	...	0.0087
"	"	40	3 22	...	0.0106
Rb. Chromium Alum	$RbCr(SO_4)_2.12H_2O$	25	2 57	4 34	0.0079
"	"	30	3 17	...	0.0096
"	"	35	4 11	...	0 0128
"	"	40	5 97	...	0.0181
Rb. Vanadium Alum	$RbV(SO_4)_2.12H_2O$	25	5 79	9 93	0.0177
Rb. Iron Alum	$RbFe(SO_4)_2.12H_2O$	25	9 74	16.98	0.0294
"	"	30	20 24	...	0.0617

Biltz and Wilke, 1906, find for the solubility of rubidium iron alum in water, at 6.6°, 4.55 gms. per 100 cc. solution; at 25°, 29 gms; and at 40°, 52.6 gms.

RUBIDIUM FLUOBORIDE $RbBF$.

100 gms. H_2O dissolve 0.55 gm. $RbBF_4$ at 20°, and 1 gm. at 100°. (Godeffroy, 1876.)

RUBIDIUM BROMIDE RbBr.

SOLUBILITY IN WATER.
(Rimbach, 1905)

t°.	Gms. RbBr per 100 Gms Water	Solution.	t°.	Gms. RbBr per 100 Gms. Water.	Solution.
0.5	89.6	47.26	39.7	131.85	56.87
5	98	49.50	57.5	152.47	60.39
16	104.8	51.17	113.5	205.21	67.24

Freezing-point data for RbBr + AgBr are given by Sandonnini (1912a).

RUBIDIUM BiCARBONATE $RbHCO_3$.

100 gms. sat. solution in H_2O contain 53.73 gms. $RbHCO_3$ at about 20°. (de Forcrand, 1909.)

RUBIDIUM CARBONATE Rb_2CO_3.

100 gms. absolute alcohol dissolve 0.74 gm. Rb_2CO_3. (Bunsen.)

RUBIDIUM CHLORATE $RbClO_3$.

SOLUBILITY IN WATER.
(Calzolari, 1912.)

t°.	Gms. $RbClO_3$ per 100 Gms. H_2O.	t°.	Gms. $RbClO_3$ per 100 Gms. H_2O.
0	2.138	42.2	12.48
8	3.07	50	15.98
19.8	5.36	76	34.12
30	8	99	62.8

There is some uncertainty as to whether the results of Calzolari refer to 100 gms. of H_2O or 100 gms. of saturated solution.

100 gms. H_2O dissolve 3.1 gms. $RbClO_3$ at 15° (d_{15} of the sat. sol. = 1.07). (Carlson, '10.)

For earlier data see Reissig, 1863.

RUBIDIUM PerCHLORATE $RbClO_4$.

SOLUBILITY IN WATER.
(Carlson, 1910, Calzolari, 1912.)

t°.	Gms. $RbClO_4$ per 100 Gms H_2O (Calzolari.)	(Carlson.)	t°.	Gms. $RbClO_4$ per 100 Gms. H_2O (Calzolari.)	(Carlson.)
0	0.5	1.1 (1.007)	50	3.5	4.6
10	0.6	1.2	60	4.85	6.27 (1.028)
20	1	1.56 (1.010)	70	6.72	8.2
25	1.2	1.8	80	9.2	11.04 (1.050)
30	1.5	2.2	90	12.7	15.5
40	2.3	3.26 (1.017)	100	18	22 (?) (1.070)

The figures in parentheses are densities of sat. solutions.

100 gms. H_2O dissolve 1.08 gm. $RbClO_4$ at 21.3°. (Longuimine, 1862.)

RUBIDIUM Potassium PerCHLORATE $Rb_2K(ClO_4)_3$.

100 gms. sat. solution in H_2O contain 1.55 gms. $Rb_2K(ClO_4)_3$ at 20° (d_{20} of the sat. solution = 1.013). (Carlson, 1910.)

RUBIDIUM CHLORIDE RbCl.

SOLUBILITY IN WATER.
(Rimbach, 1902; Berkeley, 1904.)

t°.	Mols. RbCl per Liter.	Gms. RbCl per 100 Gms. Water.	Solution.	t°.	Mols. RbCl per Liter.	Gms. RbCl per 100 Gms. Water.	Solution.
0	5.17	77.0	43.5	60	6.90	115.5	53.6
10	5.55	84.4	45.8	70	7.12	121.4	54.8
20	5.88	91.1	47.7	80	7.33	127.2	56.0
30	6.17	97.6	49.4	90	7.52	133.1	57.1
40	6.43	103.5	50.9	100	7.71	138.9	58.9
50	6.67	109.3	52.2	112.9	7.95	146.6	59.5

The following determinations of the Sp. Gr. of the sat. solutions are given by Berkeley.

t°.	0.55	18.7	31.5	44.7	60.25	75.15	89.35	114*
Sp. Gr.	1.4409	1.4865	1.5118	1.5348	1.5558	1.5746	1.5905	1.6148

* Boiling-point.

100 gms. methyl alcohol dissolve 1.41 gms. RbCl at 25°. (Turner and Bissett, 1913.)
" ethyl " " 0.078 gm. " " " " " "
" propyl " " 0.015 " " " " " "
" amyl " " 0.0025 " " " " " "

100 cc. anhydrous hydrazine dissolve 5 gms RbCl at room temp. (Welsh and Broderson, 1915.)

Freezing-point data (solubility, see footnote, p. 1) for RbCl + AgCl and RbCl + TlCl are given by Sandonnini (1911, 1914). Results for RbCl + NaCl are given by Zemcznzny and Rambach (1910).

RUBIDIUM TELLURIUM CHLORIDE Rb_2TeCl_6.

100 gms. aq. HCl of 1.2 Sp. Gr. dissolve 0.34 gm. Rb_2TeCl_6 at 23°.
100 gms. aq. HCl of 1.05 Sp. Gr. dissolve 13.09 gms. Rb_2TeCl_6 at 23°.
(Wheeler, 1893.)

RUBIDIUM THALLIUM CHLORIDE $3RbCl.TlCl_3.2H_2O$.

100 gms. H_2O dissolve 13.3 gms. at 18°, and 62.5 gms. at 100°. (Godeffroy, 1886.)

RUBIDIUM CHROMATE (Mono) Rb_2CrO_4.

SOLUBILITY IN WATER.
(Schreinemakers and Filippo, Jr., 1906.)

t°.	Gms $RbCrO_4$ per 100 Gms. Solution.	t°.	Gms. $RbCrO_4$ per 100 Gms. Solution.	t°.	Gms. $RbCrO_4$ per 100 Gms. Solution.
−7	36.65	50	47.44	−2.40	15.58
0	38.27	60.4	48.90	−3.25	20.03
10	40.23	Solid Phase, Ice		−4.14	24.28
20	42.42	−0.6	0.95	−5.55	30.15
30	44.11	−1.1	7.22	−6.71	34.31
40	46.13	−1.57	9.87	about −7	36.65

EQUILIBRIUM IN THE SYSTEM RUBIDIUM OXIDE, CHROMIUM TRIOXIDE AND WATER AT 30°.
(Schreinemakers and Filippo, Jr., 1906.)

Gms per 100 Gms Sat. Sol.		Solid Phase.	Gms per 100 Gms Sat. Sol.		Solid Phase.
CrO_3.	Rb_2O.		CrO_3.	Rb_2O.	
0	60.56	RbOH	13.91	3.38	$Rb_2Cr_2O_7$
0	56.82	Rb_2CrO_4	15.05	3.45	" $+Rb_2Cr_3O_{10}$
0.776	37.88	"	15.31	3.59	$Rb_2Cr_2O_7$
2.89	34.89	"	15.19	3.19	$Rb_2Cr_3O_{10}$
4.96	30.20	"	18.96	2.37	"
8.54	28.17	"	24.92	1.66	"
11.98	27.99	"	37.34	1.61	"
15.38	28.73	"	48.20	1.54	"
15.54	28.55	" $+Rb_2Cr_2O_7$	53.87	1.67	"
13.69	23.87	$Rb_2Cr_2O_7$	54.29	1.28	" $+Rb_2Cr_4O_{13}$
9.98	17.56	"	58.69	1.07	$Rb_2Cr_4O_{13}$
5.72	8.47	"	62.38	0.93	"
4.58	7.98	"	62.74	0.93	"
4.87	4.60	"	63.07	0.92	" $+CrO_3$
8.16	3.57	"	62.28	0	CrO_3

RUBIDIUM DICHROMATE $Rb_2Cr_3O_7$.

SOLUBILITY OF THE POLYMORPHIC FORMS IN WATER.
(Stortenbecker, 1907; see also Wyrouboff, 1901.)

t°.	Gms. $Rb_2Cr_3O_7$ per 100 Gms. Sat. Sol.	
	Monoclinic Form.	Triclinic Form.
18	5.42	4.96
24	6.94	6.55
30	9.08	8.70
40	13.22	12.90
50	18.94	18.77
65	28.10	27.30

100 gms. sat. aq. solution contain 9.47 gms. $Rb_2Cr_2O_7$, at 30°.
(Schreinemakers and Filippo, Jr., 1906.)

RUBIDIUM FLUORIDE $RbF.1\frac{1}{2}H_2O$.

100 gms. H_2O dissolve 130.6 gms. RbF at 18°. (de Forcrand, 1911.)

RUBIDIUM HYDROXIDE RbOH.

100 gms. sat. aqueous solution contain 63.39 gms. RbOH at 30°. (Schreinemakers and Filippo, 1906.)

100 gms. sat. aqueous solution contain 64.17 gms. RbOH at 15°. (de Forcrand, 1909a.)

Fusion-point data for mixtures of RbOH + NaOH are given by (v. Hevesy, 1900).

RUBIDIUM IODATE $RbIO_3$.

100 gms. H_2O dissolve 2.1 gms. $RbIO_3$ at 23°. (Wheeler, 1892)

RUBIDIUM PerIODATE $RbIO_4$.

100 gms. H_2O dissolve 0.65 gm. $RbIO_4$ at 13°, d_{13} of sat. solution = 1.0052. (Barker, 1908)

RUBIDIUM IODIDE RbI.

100 gms. H_2O dissolve 137.5 gms. RbI at 6.9°, and 152 gms at 17.4°. (Reissig, 1863.)

SOLUBILITY OF RUBIDIUM IODIDE IN ORGANIC SOLVENTS.
(Walden, 1906.)

Solvent	Formula.	Gms RbI per 100 cc. Solution	
Acetonitrile	CH_3CN	1.478 at 0°	1.350 at 25°
Propionitrile	C_2H_5CN	0.274 "	0.305 "
Nitromethane	CH_3NO_2	0.567 "	0.518 "
Acetone	$(CH_3)_2CO$	0.960 "	0.674 "
Furfurol	$C_4H_3O.COH$	...	4.930 "

Fusion-point data for RbI + AgI are given by Sandonnini (1912a).

RUBIDIUM PerIODIDES

SOLUBILITY IN WATER AT 25°.
(Foote and Chalker, 1908)

Gms per 100 Gms. Sat Sol RbI	I	Solid Phase.	Gms per 100 Gms Sat Sol RbI	I	Solid Phase.
61.93	0	RbI	28.01	64.85	RbI_3+I
59.94	5.90	" +RbI_3	27.85	65.12	"
57.24	8.02	RbI_3	27.83	65.13	"
33.89	38.08	"	27.99	64.98	"

The results show that RbI_7 and RbI_9 are not formed.

RUBIDIUM BROMIODIDE $RbBr_2I$.

100 gms. sat. aq. solution contain about 44 gms. $RbBr_2I$, and the Sp. Gr. of the solution is 3.84. (Wells and Wheeler, 1892.)

RUBIDIUM IRIDATE and IRIDITES

SOLUBILITIES IN WATER.
(Delépine, 1908.)

Salt.	Formula.	t°	Gms. Salt per 100 Gms H_2O.
Rubidium Chloroiridate	Rb_2IrCl_6	19	0.0555
Trirubidium Hexachloroiridite	$Rb_3IrCl_6.H_2O$	19	0.91
Dirubidium Aquopentachloroiridite	$Rb_2IrCl_5(H_2O)$	19	1.05

RUBIDIUM ParaMOLYBDATE $5Rb_2O.12MoO_3.H_2O$.

100 cc. sat. aq. solution contain 1.941 gms. of the salt at 24°. (Wempe, 1912.)

RUBIDIUM NITRATE $RbNO_3$.

SOLUBILITY IN WATER.
(Berkeley, 1904.)

t°.	Mols. $RbNO_3$ Per Liter.	Grams $RbNO_3$ per 100 Gms. Water.	Grams $RbNO_3$ per 100 Gms. Solution.	t°.	Mols. $RbNO_3$ Per Liter.	Gms. $RbNO_3$ per 100 Gms. Water	Gms. $RbNO_3$ per 100 Gms. Solution.
0	1.27	19.5	16.3	60	7.99	200	66.7
10	2.04	33.0	24.8	70	9.02	251	71.5
20	3.10	53.3	34.6	80	9.93	309	75.6
30	4.34	81.3	44.8	90	10.77	375	78.9
40	5.68	116.7	53.9	100	11.54	452	81.9
50	6.88	155.6	60.9	118.3	12.76	617	86.1

The following Sp. Gr. determinations are also given by Berkeley.

t°.	0.6	15.85	31.55	45.85	63.4	75.60	90.95	118.3*
Sp. Gr. Sat. Sol.	0.1389	1.2665	1.4483	1.6216	1.8006	1.9055	2.0178	2.1867

* Boiling-point.

THE SOLUBILITY AND SUPERSOLUBILITY ICE CURVES FOR RUBIDIUM NITRATE AND WATER.
(Jones, 1908.)

t°. of Cryst. of Ice.	Gms. $RbNO_3$ per 100 Gms. H_2O. Solubility Curve.	Gms. $RbNO_3$ per 100 Gms. H_2O. Supersolubility Curve.	t° of Cryst. of Ice.	Gms. $RbNO_3$ per 100 Gms H_2O. Solubility Curve.	Gms. $RbNO_3$ per 100 Gms H_2O. Supersolubility Curve.
−0.4	1.16	...	−3.5	...	9.94
−1.8	...	1.24	−2.3	13.97	...
−2.1	...	5.39	−4.2	...	13.97
−1.7	9.94	...	−2.7 Cryohydrate	17.11	...

RUBIDIUM Telluric Acid OXALATE $Rb_2[H_6TeO_6.C_2O_4]$.

SOLUBILITY IN WATER.
(Rosenheim and Weinheber, 1910–11.)

t°.	0°	20°	30°	40°	50°
Gms. $Rb_2[H_6TeO_6.C_2O_4]$ per 100 gms. H_2O	3.85	7.26	9.40	12.76	16.90

RUBIDIUM PERMANGANATE $RbMnO_4$.

One liter of aqueous solution contains 6.03 gms. $RbMnO_4$ at 7°.
(Muthmann and Kuntze, 1894.)

100 cc. sat. aq. solution contain 0.46 gm. $RbMnO_4$ at 2°, 1.06 gms. at 19° and 4.68 gms. at 60°. (Patterson, 1906.)

RUBIDIUM SELENATE Rb_2SeO_4.

100 gms. H_2O dissolve 158.9 gms. Rb_2SeO_4 at 12°. (Tutton, 1897.)

SOLUBILITY OF MIXED CRYSTALS OF RUBIDIUM ACID SELENATE AND RUBIDIUM ACID TELLURATE AND OF RUBIDIUM ACID SULFATE AND RUBIDIUM ACID TELLURATE IN WATER AT 25°. (Pellini, 1909.)

Results for $RbHSeO_4 + RbHTeO_4$. Gms. per 1000 cc. Sat. Sol. $RbHSeO_4$.	$RbHTeO_4$.	Mol % Selenate in Solid Phase.	Results for $RbHSO_4 + RbHTeSO_4$. Gms per 1000 cc Sat Sol. $RbHSO_4$.	$RbHTeO_4$.	Mol. % Sulfate in Solid Phase.
76.46	39.51	51.55	26.675	38.403	47.91
95.82	35.30	52.22	32.117	31.58	50.33
171.70	22.98	53.95	42.917	26.764	50.74
462.80	5	56.33	59.074	20.182	50.99
859.30	3.40	67.46	498.25	0.02887	52.52

RUBIDIUM FLUOSILICATE Rb_2SiF_6.

100 gms. H_2O dissolve 0.16 gm. Rb_2SiF_6 at 20°, and 1.36 gms. at 100°. (Stolba, 1867.)

RUBIDIUM SILICOTUNGSTATE $Rb_8SiW_{12}O_{42}$.

100 gms. H_2O dissolve 0.65 gm. $Rb_8SiW_{12}O_{42}$ at 20°, and 5.1 gms. at 100°. (Godeffroy, 1876.)

RUBIDIUM SULFATE Rb_2SO_4. SOLUBILITY IN WATER.

SOLUBILITY IN WATER.
(Etard, 1894; Berkeley, 1904.)

t°.	Mols. Rb_2SO_4 per Liter.	Gms. Rb_2SO_4 per 100 Gms. Water.	Gms. Rb_2SO_4 per 100 Gms. Solution.	t°.	Mols. Rb_2SO_4 per Liter.	Gms. Rb_2SO_4 per 100 Gms. Water.	Gms. Rb_2SO_4 per 100 Gms. Solution.
0	1.27	36.4	27.3	60	2.15	67.4	40.3
10	1.46	42.6	29.9	70	2.25	71.4	41.7
20	1.64	48.2	32.5	80	2.34	75.0	42.9
30	1.79	53.5	34.9	90	2.42	78 7	44.0
40	1.92	58 5	36 9	100	2.49	81.8	45.0
50	2.04	63.1	38 7	102.4	2.50	82 6	45.2

The following Sp. Gr. determinations are also given by Berkeley.

t°.	0.5	15.80	31 6	44.2	57.90	74.75	89 45	102.4*
Sp.Gr.Sat.Sol.	1.2740	1.3287	1.3704	1.3998	1 4232	1.4480	1.4649	1.4753

* b. pt.

100 cc. sat. solution in absolute H_2SO_4 contain 58.81 gms. Rb_2SO_4. (Bergius, 1910.)

SOLUBILITY OF RUBIDIUM DOUBLE SULFATES IN WATER AT 25°
(Locke, 1902)

Formula.	Per 100 cc. H_2O Gms Anh. Salt.	Per 100 cc. H_2O Mols. Salt.	Formula.	Per 100 cc. H_2O Gms. Anh. Salt.	Per 100 cc. H_2O Mols. Salt.
$Rb_2Cd(SO_4)_2.6H_2O$	76.7	0.1615	$Rb_2Mn(SO_4)_2.6H_2O$	35.7	0.0857
$Rb_2Co(SO_4)_2.6H_2O$	9.28	0.022	$Rb_2Mg(SO_4)_2.6H_2O$	20.2	0.0521
$Rb_2Cu(SO_4)_2.6H_2O$	10.28	0.0241	$Rb_2Ni(SO_4)_2.6H_2O$	5.98	0.0142
$Rb_2Fe(SO_4)_2.6H_2O$	24.28	0.0579	$Rb_2Zn(SO_4)_2.6H_2O$	10.10	0.0236

RUBIDIUM Dihydroxy **TARTARIC ACID** $Rb_2C_4H_4O_8.3H_2O$.

100 gms. H_2O dissolve 6.51 gms. $Rb_2C_4H_4O_8.3H_2O$ at 0°. (Fenton, 1898.)
On account of the unstable character of the compound, only ½ hour was allowed for saturation of the solution.

RUTHENIUM SALTS

SOLUBILITIES IN WATER.
(Howe, 1894)

Salt.	Formula.	t°.	Gms Salt per 100 Gms. H_2O.
Ruthenium Potassium Nitrosochloride	K_2RuCl_5NO	25	12
" " "	"	60	80
" Ammonium Nitrosochloride	$(NH_4)_2RuCl_5NO$	25	5
" " "	"	60	22
" Rubidium Nitrosochloride	Rb_2RuCl_5NO	25	0.57
" " "	"	60	2.13
" " " (hydrated)	$Rb_2RuCl_5NO.2H_2O$	25	114.3
" Caesium Nitrosochloride	Cs_2RuCl_5NO	25	0.20
" " "	"	60	0.56
" " " (hydrated)	$Cs_2RuCl_5.NO.2H_2O$	25	105.8

SACCHARIN (1, Benzosulfonazole, 2(1), one) $C_6H_4<{SO_2 \atop CO}>NH$.

100 parts H_2O dissolve 0.4 part at 25° and 4.17 parts at 100°.
100 parts alcohol dissolve 4 parts at 25°. (U. S. P. VIII.)
100 gms. trichlorethylene dissolve 0.012 gm. saccharin at 15°. (Wester and Bruins, 1914.)

DISTRIBUTION OF SACCHARIN AT 25° BETWEEN:

Water * and Ether. (Marden, 1914.)

Gms. Saccharin per: 100 cc. H_2O Layer.	50 cc. Ether Layer	Dist. Coef.
0.0290	0.0438	0.267
0.0458	0.0829	0.235
0.0719	0.1245	0.245

Water † and Amyl Acetate. (Marden, 1914.)

Gms. Saccharin per: 105 cc. Aq. Layer.	50 cc. Amyl Acetate Layer.	Dist. Coef.
0.0045	0.0700	0,0306
0.0065	0.0957	0.0322
0.0114	0.1724	0.0315

* Slightly acidified with HCl. † Containing 5 cc. conc. HCl per 100 cc.

The amount of saccharin entering the ethereal layer is increased by addition of HCl to the aqueous layer. With 5 cc. conc. HCl per 100 cc. H_2O, the distribution coefficient is reduced to 0.0624.

SALICIN $C_6H_4(CH_2.OH)O.C_6H_{11}O_5$.

SOLUBILITY IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms per 100 Gms. Solvent.	Authority.
Water	15	3.52	(Greenish and Smith, 1903.)
Water	25	4.16	(Dott, 1907.)
90% Alcohol	15	1.5	(Greenish and Smith, 1903.)
90% Alcohol	15	2	(Squire and Caines, 1905.)
Trichlor Ethylene	15	0.013	(Wester and Bruins, 1914.)

SALICYLAMIDE $OH.C_6H_4CONH_2$.

DISTRIBUTION BETWEEN WATER AND OLIVE OIL.

(Meyer, 1901)

t°.	Gms. $OHC_6H_4CONH_2$ per 100 cc. H_2O Layer.	Oil Layer.	Dist. Coef.
3	0.056	0.126	2.25
36	0.075	0.107	1.40

SALICYLIC ACID $C_6H_4.OH.COOH$ 1:2.

SOLUBILITY IN WATER.

(Average curve from the closely agreeing determinations of Walker and Wood, 1898; at 26.4°, Philip, 1905; at 25°, Paul, 1894; at 20°, Hoitsema, 1898a; Hoffman and Langbeck, 1905 For determinations not in good agreement with the following, see Alexejew, 1886; Bourgoin, 1878; Ost, 1878.)

t°.	Gms C_6H_4 OH.COOH per Liter Solution.	t°.	Gms. C_6H_4 OH COOH per Liter Solution.	t°.	Gms C_6H_4.OH.COOH per Liter Solution.
0	0.8	25	2.2	60	8.2
10	1.2	30	2.7	70	13.2
20	1.8	40	3.7	80	20.5
		50	5.4		

SOLUBILITY OF SALICYLIC ACID IN WATER

(Savorro, 1914.)

t°.	Gms. C_6H_4 OH COOH per 1000 Gms. Sat. Sol.	t°.	Gms. C_6H_4.OH COOH per 1000 Gms. Sat. Sol.	t°.	Gms. C_6H_4.OH.COOH per 1000 Gms. Sat. Sol.
0	1.24	35	3.51	70	13.70
5	1.29	40	4.16	75	17.55
10	1.35	45	4.89	80	22.08
15	1.84	50	6.38	85	27.92
20	2	55	7.44	90	37.35
25	2.48	60	9	95	50.48
30	2.98	65	10.94	100	75.07

SOLUBILITY OF SALICYLIC ACID (LIQUID) IN WATER.

Determinations by Synthetic Method. See Note, p. 16. The original data in each case were plotted and the following figures read from the curves.

t°.	(Alexejew.) Gms. $C_6H_4OHCOOH$ per 100 Gms. Aqueous Layer	Salicylic Acid Layer.	t°.	(Flaschner and Rankin, 1910.) Gms. $C_6H_4OHCOOH$ per 100 Gms. Aqueous Layer.	Salicylic Acid Layer.
60	7	68	60	4.5	68
70	8	64	70	6.5	62.5
80	12	58	80	10	54
90	19	49	85	15	46
95 crit. temp.	32		87 crit. temp.	30	

Data for the melting-point curve of mixtures of solid salicylic acid and water are also given by Flaschner and Rankin.

SOLUBILITY OF SALICYLIC ACID IN AQUEOUS SALT SOLUTIONS AT 25° AND AT 35°. (Hoffman and Langbeck, 1905.)

Salt.	Normality of Salt Solution.	Gms. Salt per Liter.	C_6H_4OH COOH Dissolved at 25°. Gms per 1000 Gms. Sat. Sol.	Gm Mol Per cent.	C_6H_4OH COOH Dissolved at 35°. Gms per 1000 Gms. Sat. Sol.	Gm Mol. Per cent.
KCl	0.020	1.49	2.24	$2.9216.10^{-4}$	3.23	$4.2206.10^{-4}$
"	0.100	7.46	2.25	2.9377 "	3.23	4.2203 "
"	0.492	36.73	2.02	2.6321 "	3.01	3.9268 "
"	1.004	74.92	1.89	2.4759 "	2.68	3.5003 "
KNO_3	0.020	2.02	2.25	3.9351 "	3.25	4.2499 "
"	0.100	10.12	2.30	3.0103 "	3.32	4.3334 "
"	0.504	51.10	2.38	3.1061 "	3.38	4.4123 "
"	1.004	101.60	2.39	3.1249 "	3.36	4.3848 "
NaCl	0.020	1.19	2.23	2.9110 "	3.22	4.2062 "
"	0.100	5.95	2.22	2.9027 "	3.20	4.1806 "
"	0.497	29.50	2	2.6128 "	2.85	3.7171 "
"	0.988	58.80	1.72	2.2487 "	2.43	3.1596 "

SOLUBILITY OF SALICYLIC ACID IN AQUEOUS SALT SOLUTIONS AT 25°. (Philip, 1905; Philip and Garner, 1909)

In Aq. Sodium Acetate. Gms per Liter. CH_3COONa.	$C_6H_4OHCOOH$.	In Aq. Sodium Formate. Gms. per Liter. HCOONa.	$C_6H_4OHCOOH$.	In Aq. Sodium Monochlor Acetate. Gms. per Liter. $CH_2ClCOONa$.	$C_6H_4OHCOOH$.
1.01	3.60	0.81	3.40	1.38	2.83
2.48	5.93	1.63	4.42	3.43	3.58
5.03	9.56	4.06	7.11	6.84	4.64
10.07	16.81	8.14	10.44	13.71	6.17

In Aq. Sodium Succinate. Gms. per Liter. $C_2H_4(COONa)_2$.	$C_6H_4OHCOOH$.	In Aq. Potassium Formate. Gms. per Liter. HCOOK.	$C_6H_4OHCOOH$.	In Aq. Sodium Butyrate at 26.4°. Gms. per Liter. C_3H_7COONa.	$C_6H_4OHCOOH$.
1.18	2.97	0	2.265	1	3.3
2.93	4.34	1.03	3.38	2	4.5
5.85	6.56	2.56	4.93	4	6.85
11.73	10.82	5.12	7.13	5	8.1

One liter of 1 normal aqueous sodium salicylate solution dissolves 4.97 gms. salicylic acid at 25°. (Sidgwick, 1910.)

SOLUBILITY OF SALICYLIC ACID IN AQUEOUS SOLUTIONS OF SODIUM SALICYLATE AT 20.1°.

(Hoitsema, 1898a.)

Gm. Mols. per Liter. $C_6H_4OH\text{-}COOH$.	Gm. Mols. per Liter. $C_6H_4OH\text{-}COONa$.	Sp. Gr. of Solutions.	Gms. per Liter. $C_6H_4OH\text{-}COOH$.	Gms. per Liter. $C_6H_4OH\text{-}COONa$.	Solid Phase.
0.0132	0	1.002	1 823	0	$C_6H_4OHCOOH$
0.0112	0.017	1.003	1 55	2.705	"
0.0124	0.113	1.009	1.71	17.98	"
0 0143	0.226	1.016	1 97	35.96	"
0 0164	0 344	1.024	2 26	54.74	"
0.0203	0.500	1.034	2.80	79 56	"
0.062	1.70	1.112	8.56	270.5	"
0.095	2.11	1.137	13.11	335.7	$C_6H_4OHCOOH\ C_6H_4OHCOONa + C_6H_4OHCOOH$
0.091	2.19	1.144	12 56	348 4	$C_6H_4OHCOOH.C_6H_4OHCOONa$
0.086	3.41	1.215	11.88	542.6	"
0.081	4.23	1.263	11.19	673	$C_6H_4OHCOOH.C_6H_4OHCOONa + C_6H_4OHCOONa$
0.048	4.18	1.259	6.63	665.1	$C_6H_4OHCOONa$
0.021	4 12	1.258	2 90	665.5	"
0.	4.15	1.257	0	660.3	"

SOLUBILITY OF SALICYLIC ACID IN AQUEOUS SOLUTIONS OF ACIDS AT 25°.

(Kendall, 1911.)

Acid.	Gms. per Liter. Acid.		Gms. per Liter. $C_6H_4OH\text{-}COOH$	Acid.	Gms. per Liter. Acid		Gms. per Liter. $C_6H_4OH\text{-}COOH$.
Water alone	0		2 257	Formic Acid	230.15	HCOOH	2.370
Acetic Acid	37 52	CH_3COOH	2 335	"	460 30	"	2.901
"	75 05	"	2 409	Hydrochloric Acid	0 653	HCl	1.781
"	150 10	"	2.549	"	1.302	"	1.710
"	300.20	"	2 850	"	4 558	"	1 677
Formic Acid	2 38	HCOOH	2 114	"	9.117	"	1.649
"	4.59	"	2.035	"	18.235	"	1.551
"	11 05	"	2 114	Malonic Acid	3 253	$CH_2(COOH)_2$	2.051
"	21.17	"	2 035	"	10.49	"	1 944
"	28.76	"	2.049	"	20.84	"	1.880
"	57.53	"	2 066	Methyl Picric Acid	2.28	$C_7H_5O_7N_3$	2.115
"	115.07	"	2.121				

SOLUBILITY OF SALICYLIC ACID IN AQUEOUS SOLUTIONS OF *o* NITROBENZOIC ACID AT 25° AND VICE VERSA.

(Kendall, 1911.)

Gms per Liter. *o* $C_6H_4NO_2$-COOH.	Gms per Liter. *o* C_6H_4-OHCOOH.	Solid Phase.	Gms. per Liter. *o* $C_6H_4.NO_2$-COOH.	Gms. per Liter. *o* C_6H_4 OH-COOH.	Solid Phase.
0	2.257	Salicylic Acid	7.188	2.243	*o* Nitrobenzoic Acid
2.615	1.974	"	7.213	1.873	
7.202	1 887	"	7.233	1.294	
7.283	1.885	" +Nitrobenzoic			

SOLUBILITY OF SALICYLIC ACID IN AQUEOUS ALCOHOL AT 25°.

(Seidell, 1908, 1909, 1910)

Wt. Per cent C_2H_5OH in Solvent.	d_{25} Sat. Sol.	Gms. $C_6H_4OHCOOH$ per 100 Gms. Sat. Sol	Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_6H_4OHCOOH$ per 100 Gms. Sat. Sol.
10	0.984	0.38	60	0.943	18.30
20	0 970	0.80	70	0.941	24
30	0.959	2.20	80	0.937	28.30
40	0.951	5.90	90	0.930	31.40
50	0.945	12.20	100	0.919	33.20

SOLUBILITY OF SALICYLIC ACID IN AQUEOUS SOLUTIONS OF ETHYL ALCOHOL, ISOBUTYL ALCOHOL, DEXTROSE, CANE SUGAR, AND OF LEVULOSE AT 25° AND AT 35°.

(Hoffmann and Langbeck, 1905.)

Aq. Solvent.	Conc. of Solvent.		$C_6H_4OH.COOH$ Dissolved at 25°.		$C_6H_4OH\ COOH$ Dissolved at 35°.	
	Normality.	Gms. per Liter.	Gm. Mol. Per cent.	Gms per 100 Gms. Sat. Sol.	Gm Mol. Per cent.	Gms. per 100 Gms Sat. Sol.
C_2H_5OH	0.0249	1.146	$2.8966.10^{-4}$	0.222	$4.2044.10^{-4}$	0.322
"	0.0560	2.578	2.9150 "	0.223	4.2348 "	0.324
"	0.1747	8.04	2.9901 "	0.229	...	...
"	0.2399	11.05	...	...	4.4341 "	0.339
"	1.03	47.4	3.5279 "	0.270	5.2816 "	0.404
"	1.638	75.44	3.9253 "	0.300	...	...
C_4H_9OH (iso)	0.020	1.496	2.909 "	0.223	4.229 "	0.324
"	0.051	3.74	2.955 "	0.226	4.289 "	0.329
"	0.100	7.48	3.033 "	0.232	4.435 "	0.339
"	0.521	38.60	3.718 "	0.285	5.624 "	0.431
$C_6H_{12}O_6$	0.02	3.6	2 886 "	0.221	4.184 "	0.321
"	0 10	18	2.898 "	0.222	4.202 "	0.322
"	0.50	89.6	2.954 "	0.226	4.263 "	0.326
"	1	180	3.015 "	0.231	4.360 "	0.334
$C_{12}H_{22}O_{11}$	0 02	6.88	2.902 "	0.221	4.206 "	0.322
"	0.10	34.97	2 964 "	0.227	4.287 "	0.328
"	0.50	172	3.239 "	0.248	4.697 "	0.360
"	1.10	376 3	3 633 "	0.278	5.236 "	0.401
$C_6H_{12}O_6$	0.02	3 6	2.888 "	0.221	...	...
"	0.06	10.8	2.895 "	0.221	...	...
"	0.25	45	2.944 "	0.225	...	...

SOLUBILITY OF SALICYLIC ACID IN ALCOHOLS, IN ETHER AND IN ACETONE.

(Timofeiew, 1891, at 15°, Bourgoin, 1878; at 23°, Walker and Wood, 1898)

Solvent.	t°.	Gms. $C_6H_4OHCOOH$ per 100 Gms Solvent.	Solution.	Solvent.	t°.	Gms $C_6H_4OHCOOH$ per 100 Gms Solvent.	Solution.
CH_3OH	− 3	40 67	28.91	$C_3H_7OH(n)$	− 3	26.12	20.71
CH_3OH	+21	62 48	38.46	$C_3H_7OH(n)$	+21	37.69	27 36
C_2H_5OH	− 3	36.12	26.29	$(CH_3)_2O$	15	50.47	33.55
C_2H_5OH	+15	49 63	33.17	$(CH_3)_2O$	17	...	23.4*
C_2H_5OH	21	53 53	34 87	$(CH_3)_2CO$	23	...	31.3*
C_2H_5OH 90%	15	42.09	29.62				

* Gms. per 100 cc sat sol. instead of per 100 gms. sat. sol.

100 gms. sat. solution in methyl alcohol contain 39.87 gms. salicylic acid at 15°. (Savorro, 1914)

SOLUBILITY OF SALICYLIC ACID IN MIXTURES OF ACETONE AND BENZENE AT 25°.

(Marden and Dover, 1917.)

Gms. per 100 Gms. Mixed Solvent. Acetone.	Salicylic Acid.	Gms. per 100 Gms Mixed Solvent. Acetone.	Salicylic Acid.	Gms per 100 Gms Mixed Solvent. Acetone.	Salicylic Acid.
100	55	60	36.7	20	15
90	51.1	50	31	10	7.1
80	46.4	40	25.3	0	0.92
70	42.3	3c	20		

SOLUBILITY OF SALICYLIC ACID IN BENZENE.

(Walker and Wood, 1898.) (von Euler and Lowenhamn, 1916.)

t°.	Gms. C_6H_4-OHCOOH per 100 Gms. C_6H_6.	t°.	Gms. C_6H_4-OHCOOH per 100 Gms. C_6H_6.	t°.	Solvent.	Gms. C_6H_4-OHCOOH per 100 cc. Sat. Sol.
11.7	0.460	34.6	1.261	18	C_6H_6	0.525
18.2	0.579	36.6	1.430	25	C_6H_6	0.762
25	0.78	49.4	2.380	18	0.5*n* $CH_2ClCOOH$ in C_6H_6	1.698
30.5	0.991	64.2	4.40	18	0.5*n* C_6H_5OH in C_6H_6	0.746

SOLUBILITY OF SALICYLIC ACID IN MIXTURES OF BENZENE AND ETHYL ACETATE AT 25°.

(Marden and Dover, 1917.)

Gms. per 100 Gms Mixed Solvent.		Gms per 100 Gms. Mixed Solvent.		Gms. per 100 Gms. Mixed Solvent.	
Ethyl Acetate.	Salicylic Acid.	Ethyl Acetate.	Salicylic Acid.	Ethyl Acetate.	Salicylic Acid.
100	38	60	16.6	20	6.2
90	24.2	50	14.5	10	3.42
80	22.7	40	12.8	0	0.92
70	19.5	30	9.6		

SOLUBILITY OF SALICYLIC ACID IN SEVERAL SOLVENTS AT 25°.

(Herz and Rathmann, 1913.)

Solvent.	Gms. $C_6H_4OHCOOH$ per 100 cc Sat. Sol.	Solvent.	Gms. $C_6H_4OHCOOH$ per 100 cc. Sat. Sol.
Chloroform	2.168	Tetrachlor Ethylene	1.105
Carbon Tetrachloride	0.4143	Tetrachlor Ethane	2.085
Trichlor Ethylene	1.519	Pentachlor Ethane	1.064

100 gms. dichlor ethylene dissolve 0.757 gm. salicylic acid at 15°.
100 gms. trichlor ethylene dissolve 0.28 gm. salicylic acid at 15°. } (Wester and Bruins, 1914.)

SOLUBILITY OF SALICYLIC ACID IN OILS (Temp. not stated).

(Engfeldt, 1913.)

Oil of:	Gms $C_6H_4OHCOOH$ per 100 Gms. Sat Sol.	Oil of:	Gms $C_6H_4OHCOOH$ per 100 Gms. Sat. Sol.
Phocae (Dog Fish Oil)	1.70	Sesami	2.61
Jecoris Aselli (Cod Liver Oil)	1.86	Cannabis	3
Arachidis (Peanut Oil)	1.88	Lini (Linseed Oil)	3.04
Amygdalarum	2.08	Juglandis (Walnut Oil)	3.15
Olivæ (Olive Oil)	2.14	Gossypii (Cottonseed Oil)	3.23
Rapæ (Rape Seed Oil)	2.17	Ricini (Castor Oil)	12.98
Papaveris (Poppy Seed Oil)	2.22	Paraffiniam Liquid	0

The ratio of the solubilities of salicylic acid in olive oil and in water (conc. in oil ÷ conc. in H_2O) at 25° is given as 11.8 by Boeseken and Waterman (1911, 1912). This corresponds to 2.6 gms. acid per 100 gms. olive oil.

DISTRIBUTION OF SALICYLIC ACID BETWEEN:

Water and Benzene. (Hendrixon, 1897.)				Water and Chloroform. (Hendrixon, 1897.)			
Results at 10°.		Results at 40°.		Results at 10°.		Results at 40°.	
Gms. Acid 100 cc.		Gms Acid per 100 cc		Gms Acid per 100 cc.		Gms. Acid per 100 cc.	
H_2O Layer.	C_6H_6 Layer.	H_2O Layer	C_6H_6 Layer.	H_2O Layer.	$CHCl_3$ Layer.	H_2O Layer.	$CHCl_3$ Layer.
0.0264	0.0391	0.0260	0.0400	0.0293	0.0442	0.0335	0.0475
0.0377	0.0655	0.0719	0.1649	0.0457	0.0946	0.0819	0.1775
0.1200	0.4159	0.1220	0.3539	0.1172	0.5640	0.1589	0.5297
0.1292	0.4713	0.1563	0.5016	0.1229	0.6196	0.2687	1.3887
		0.2014	0.7625	0.1236	0.6269	0.3053	1.7570

Similar data for the distribution between water and benzene at 18° are given by Nernst (1891).

Acetyl **SALICYLIC ACID** (Aspirin) $CH_3COO.C_6H_4.COOH$, 1.2.

SOLUBILITY AND MELTING-POINT CURVES FOR MIXTURES OF ACETYL SALICYLIC ACID AND WATER, DETERMINED BY THE SYNTHETIC METHOD.
(Flaschner and Rankin, 1909.)

Solubility Curve (Liquid Acid + H_2O).			M.-pt. Curve (Solid Acid + H_2O).	
t°.	Gms. $CH_3COO.C_6H_4.COOH$ per 100 Gms. H₂O Rich Layer.	Gms. $CH_3COO.C_6H_4.COOH$ per 100 Gms. Acid Rich Layer.	t°.	Gms. $CH_3COOC_6H_4COOH$ per 100 Gms. Mixture.
25	4.8	...	82.4	4.8
50	6	74	90.4	10
70	10	67	92.4	20
80	14	60	93.6	60
85	17.5	55	99	80
87.5	20	50	109.4	89.5
89 crit. temp.	35		131	100

SALOL (Phenylsalicylate) $C_6H_4.OH.COOC_6H_5$, 1.2.

SOLUBILITY OF SALOL IN AQUEOUS ALCOHOL AT 25°. (Seidell, 1909, 1910.)

Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. Salol per 100 Gms. Sat. Sol.	Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. Salol per 100 Gms. Sat. Sol.
0	0.999	0.015	70	0.877	4.40
20	0.967	0.020	80	0.863	7.70
40	0.934	0.22	90	0.865	14
50	0.914	0.76	92.3	0.868	17.70
60	0.895	2.10	100	0.898	35

SOLUBILITY OF SALOL IN SEVERAL SOLVENTS. (Seidell, 1907.)

Solvent.	t°.	d Sat. Sol.	Gms. Salol per 100 Gms. Sat. Sol.	Solvent	t°.	d Sat. Sol.	Gms. Salol per 100 Gms. Sat. Sol.
Acetone	30–31	...	90.99	Amyl Alcohol	25	0.869	20.44
Benzene	30–31	1.148	88.57	Acetic Acid (99.5%)	21.5	1.143	63.24
Amyl Acetate	30–31	1.136	85.29	Xylene	32.5	...	87.14+
Aniline	30–31	...	very soluble	Toluene	25	1.128	83.62

100 gms. pyridine dissolve 381 gms. salol at 20°–25° (Dehn, 1917). The solution in aqueous 50 per cent pyridine separates into two layers.

SOLIDIFICATION TEMPERATURES (Solubility, see footnote, p. 1) FOR MIXTURES OF:

Salol and Thymol. (Bellucci, 1912.)				Salol and Urethan. (Bellucci, 1912, 1913.)			
t° of Solidif.	Gms. Salol per 100 Gms. Mixture.	t° of Solidif.	Gms. Salol per 100 Gms. Mixture.	t° of Solidif.	Gms. Salol per 100 Gms. Mixture.	t° of Solidif.	Gms. Salol per 100 Gms. Mixture.
42	100	23	50	42	100	36.5	50
34	90	29	40	36.5	90	39	40
26	80	34.5	30	29 Eutec.	86	41.5	30
18	70	40	20	31	80	44	20
13 Eutec.	66	46	10	30	70	47	10
17.5	60	51	0	34	60	48.5	0

The Eutec. for salol + camphor is at +6° and contains 56% salol. (Bellucci, 1912, 13.)
The Eutec. for salol + monobromcamphor is at 21° and contains 60% salol.

Solidification temperatures for Salol + Sulfonal and for Salol + β Naphthol are given by Bianchini (1914).

SANTONIN $C_{15}H_{18}O_3$.

SOLUBILITY IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. $C_{15}H_{18}O_3$ per 100 Gms. Solvent.	Authority.
Water	20–25	0.02+	(Dehn, 1917.)
Alcohol (90%)	15	about 2.3	(Greenish and Smith, 1903.)
Trichlor Ethylene	15	2.46	(Wester and Bruins, 1914.)
Pyridine	20–25	12.72	(Dehn, 1917.)
Aq. 50% Pyridine	20–25	12.35	"

F.-pt. data for mixtures of stereoisomeric santonin salts are given by Malvino and Manino (1908).

SAMARIUM CHLORIDE $SaCl_3$.

100 gms. pyridine dissolve 6.38 gms. $SaCl_3$ at 15°. (Matignon, 1906, 1909.)

SAMARIUM GLYCOLATE $Sa(C_2H_3O_3)_3$.

100 gms. H_2O dissolve 0.6373 gm. $Sa(C_2H_3O_3)_3$ at 20°. (Jantsch and Grünkraut, 1912–13.)

SAMARIUM Double **NITRATES.**

SOLUBILITY IN CONC. HNO_3 OF $d_{14} = 1.325$ AT 16°.
(Jantsch, 1912.)

Salt.	Formula.	Gms. Hydrated Salt per 100 cc. Sat. Sol.
Samarium Magnesium Nitrate	$[Sa(NO_3)_6]Mg_3 . 24 H_2O$	24.55
" Nickel "	" Ni_3 "	29.11
" Cobalt "	" Co_3 "	34.27
" Zinc "	" Zn_3 "	36.47
" Manganese "	" Mn_3 "	50.04

SAMARIUM OXALATE $Sa_2(C_2O_4)_3.10H_2O$.

One liter H_2O dissolves 0.00054 gm. $Sa_2(C_2O_4)_3$ at 25°, determined by the electrolytic conductivity method. (Rimbach and Schubert, 1909.)

SOLUBILITY OF SAMARIUM OXALATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°.
(Wirth, 1912.)

Normality of Aq H_2SO_4.	Gm $Sa_2(C_2O_4)_3$ per 100 Gms Sat. Sol	Solid Phase.	Normality of Aq H_2SO_4	Gm $Sa_2(C_2O_4)_3$ per 100 Gms. Sat Sol	Solid Phase.
1	0.1015	$Sa_2(C_2O_4)_3.10H_2O$	2.8	0.3886	$Sa_2(C_2O_4)_3.10H_2O$
1.445	0.1804	"	4.32	0.7008	"
1.93	0.2254	"	6.175	1.072	"

SAMARIUM Dimethyl **PHOSPHATE** $Sa_2[(CH_3)_2PO_4]_6$.

100 gms. H_2O dissolve 35.2 gms. $Sa_2[(CH_3)_2PO_4]_6$ at 25° and about 10.8 gms. at 95°. (Morgan and James, 1914.)

SAMARIUM SULFATE $Sa_2(SO_4)_3$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF AMMONIUM SULFATE AT 25°.*
(Keyes and James, 1914.)

Gms. per 100 Gms. H_2O		Solid Phase.	Gms per 100 Gms H_2O		Solid Phase.
$(NH_4)_2SO_4$	$Sa_2(SO_4)_3$.		$(NH_4)_2SO_4$.	$Sa_2(SO_4)_3$.	
0.03	2.1	$Sa_2(SO_4)_3$	32.5	0.9	1.1 7
0.8	2	"	46.3	1	"
1.1	2.8	" +1 1.7	77.5	1.3	" +$(NH_4)_2SO_4$
1.9	1.5	1.1.7	77.3	0.3	$(NH_4)_2SO_4$
7.4	0.8	"	76.8	0.6	"
18.8	0.8	"			

1.1.7 = $Sa_2(SO_4)_3.(NH_4)_2SO_4.7H_2O$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AT 25°.*
(Keyes and James, 1914)

Gms. per 100 Gms. H_2O.		Solid Phase.	Gms per 100 Gms H_2O.		Solid Phase.
Na_2SO_4.	$Sa_2(SO_4)_3$.		Na_2SO_4.	$Sa_2(SO_4)_3$.	
...	2.05	$Sa_2(SO_4)_3$	10.51	0.012	$2Sa_2(SO_4)_3.3Na_2SO_4.6H_2O$
0.1	2	"	14.71	0.010	"
0.5	0.11	$2Sa_2(SO_4)_3.3Na_2SO_4.6H_2O$	20.02	0.012	"
1.9	0.03	"	23.68	0.018	"
6.44	0.016	"	27.40	0.011	"

* The mixtures were rotated at constant temperature for 5 months.

100 cc. anhydrous hydrazine dissolve 1 gm. $Sa_2(SO_4)_3$ at room temp. (Welsh and Broderson, 1915.)

SAMARIUM SULFONATES

SOLUBILITY IN WATER.

Salt.	Formula.	t°.	Gm. Anhydrous Salt per 100 Gms. H_2O.	Authority.
Samarium *m* Nitrobenzene Sulfonate	$Sa[C_6H_4(NO_2)SO_3]_3.7H_2O$	15	50.9	(Holmberg, 1907.)
Samarium Bromonitrobenzene Sulphonate	$Sa[C_6H_3(1)Br(4)NO_2(2)SO_3]_3.10H_2O$	25	7.84	(Katz and James, 1913.)

SCANDIUM OXALATE $Sc_2(C_2O_4)_3.5H_2O$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF AMMONIUM OXALATE AND OF HYDROCHLORIC ACID.

In Aq. Ammonia Oxalate at 25°. (Wirth, 1914.)

Gms per 100 Gms. Sat Sol C_2O_3	Gms per 100 Gms. Sat Sol Sc_2O_3	Solid Phase.
1.624	0.3019	$Sc_2(C_2O_4)_3.5H_2O$
2.4	0.4012	"
4.478	0.7108	" $+(NH_4)_2C_2O_4$

In Aq. Hydrochloric Acid at 25° and at 50°. (Meyer, 1914.)

Normality of Aq. HCl.	Gms $Sc_2(C_2O_4)_3$ per 100 Gms. Sat. Sol At 25°	At 50°.
0.1	0.0299	0.0420
0.5	0.0650	0.0870
1	0.1020	0.1435
2	0.1716	0.2556
5	0.4170	0.6533

SOLUBILITY IN AQUEOUS SOLUTIONS OF SULFURIC ACID.

Results at 25°. (Wirth, 1914.)

Normality of Aq. H_2SO_4.	Gms. $Sc_2(C_2O_4)_3$ per 100 Gms. Sat Sol	Solid Phase.
1	0.1148	$Sc_2(C_2O_4)_3.5H_2O$
2.1	0.2573	"
2.43	0.2904	"
3.57	0.4204	"
4.86	0.5834	"

Results at 25° and at 50°. (Meyer, 1914.)

Normality of Aq H_2SO_4	Gms $Sc_2(C_2O_4)_3$ per 100 Gms. Sat Sol At 25°	At 50°.
0.1	0.0385	0.0562
0.5	0.0997	0.1481
1	0.1663	0.2493
2	0.3176	0.4429
5	0.7761	1.1280

100 gms. sat. solution of scandium oxalate in 2.43 *n* H_2SO_4 + 0.5 *n* oxalic acid contain 0.0284 gm. Sc_2O_3 at 25°. (Wirth, 1914.)

SCANDIUM SULFATE $Sc_2(SO_4)_3.5H_2O$.

SOLUBILITY IN WATER AND IN AQUEOUS SULFURIC ACID AT 25°. (Wirth, 1914.)

Solvent.	Gms. $Sc_2(SO_4)_3$ per 100 Gms Sat. Sol	Solid Phase.	Solvent.	Gms $Sc_2(SO_4)_3$ per 100 Gms. Sat Sol.	Solid Phase.
Water	28.52	$Sc_2(SO_4)_3.5H_2O$	4.86 *n* H_2SO_4	8.363	$Sc_2(SO_4)_3.5H_2O$
0.5 *n* H_2SO_4	29.29	"	9.73 *n* H_2SO_4	1.315	"
1 *n* H_2SO_4	19.87	"	22.35 *n* H_2SO_4	0.484	$Sc_2(SO_4)_3.3H_2O$

Scandium sulfuric acid double sulfate, $Sc_2(SO_4)_3.3H_2SO_4$. 100 gms. sat. sol. in conc. H_2SO_4 of $d = 1.6$ contain 0.8616 gm. of the double salt. (Wirth, 1914.)

SEBACIC ACID $(CH_2)_8(COOH)_2$.

100 gms. 95% formic acid dissolve 1.05 gm. sebacic acid at 19°. (Aschan, 1913.)

DISTRIBUTION OF SEBACIC ACID BETWEEN WATER AND ETHER AT 25°. (Chandler, 1908.)

Mol. Concentration of Sebacic Acid in: Aq. Layer.	Ether Layer.	Ratio.
0.00062	0.0291	0.0213
0.00058	0.0272	0.0213
0.00047	0.0213	0.0221
0.00036	0.0155	0.0232

SELENIUM Se.

Solubility in Carbon Disulfide.
(Marc, 1906.)

100 cc. CS_2 dissolve 0.065 gm. amorphous Se at room temperature. Se which is heated to 180° for 6-7 hours is insoluble in CS_2. Se crystallized from the melt at 200° is insoluble in CS_2. Se heated once quickly to 140° is very slightly soluble in CS_2.

100 cc. CS_2 dissolve at the boiling-point 3-3.4 mgs. Se which has been heated to 140° for 1 hr.

100 cc. CS_2 dissolve at the boiling-point 2 mgs. Se which has been heated to 195° for 2 days. (Marc, 1907.)

100 gms. methylene iodide (CH_2I_2) dissolve 1.3 gms. Se at 12°. (Retgers, 1893.)

Solubility of Mix Crystals of Selenium and Sulfur in Carbon Disulfide at 25°. (Ringer, 1902.)

Mols. per 100 Mols. Solution CS_2.	Se.	S.	Mol. Per Cent Se in Crystals.	Mols. per 100 Mols Solution. CS_2.	Se.	S.	Mol. Per Cent Se in Crystals.
43.1	0	56.9	0	58 24	2.35	39.41	55.67
45.1	0.93	53.97	3.54	64.66	1.58	33.76	68.38
44.98	1.03	53 99	3 81	81.11	2.4	16.49	58 7
47.84	2.07	50 59	8.69	88.41	2.17	9.42	61.5
49.54	2 19	48.27	16 4*	91.38	1.68	6.94	65
47.62	2 16	50 22	14.2*	99 51	0.49	0	100†
46.12	1.485	52.39	29 35*	99.14	0.86	0	100‡

* Mix crystals homogeneous in all except these solutions.
† = Solubility of hexagonal selenium. ‡ = Solubility of amorphous selenium.

Fusion-point curves for mixtures of selenium and other metals are given by Pelabon (1909). Results for Se + Te are given by Pellini and Vio (1906).

Diphenyl SELENIUM BROMIDE $(C_6H_5)_2SeBr_2$.

Reciprocal Solubility of Diphenyl Selenium Bromide and Diphenyl Tellurium Bromide in Water at 25°.
(Pellini, 1906a)

Gms. per 1000 cc. Sat Sol. $(C_6H_5)_2TeBr_2$.	$(C_6H_5)_2SeBr_2$.	Mol. % $(C_6H_5)_2SeBr_2$ in Cryst. Mixture.	Gms per 1000 cc. Sat Sol. $(C_6H_5)_2TeBr_2$.	$(C_6H_5)_2SeBr_2$.	Mol. % $(C_6H_5)_2SeBr_2$ in Cryst. Mixture.
18.614	0	0	10.224	14 608	44.89
17.400	1 448	4 91	7.544	19.876	51.18
16.152	4 172	10 51	6 780	18.984	94.25
15.030	6 210	18 21	3.184	17.392	95.82
13.320	8.148	24 98	0	18.984	100
11.940	11.420	34.94			

SELENIC ACID H_2SeO_4

Solubility in Water, Determined by Freezing-point Method.
(Kremann and Hofmeier, 1908)

t°.	Gms. H_2SeO_4 per 100 Gms. Sat Sol.	Solid Phase.	t°.	Gms. H_2SeO_4 per 100 Gms. Sat. Sol.	Solid Phase.
0	0	Ice	−55	71.5	$H_2SeO_4.4H_2O$
−10	21	"	−65 Eutec.	74	" $+H_2SeO_4.H_2O$
−20	30	"	−50	75.5	$H_2S_2O_4.H_2O$
−30	36	"	−20	79	"
−40	40	"	0	81	"
−50	42.5	"	+20	85	"
−60	45	"	26 m. pt.	88	"
−80	48	"	20	91	"
−95 Eutec.	50	" $+H_2SeO_4.4H_2O$	16 Eutec.	91.5	" $+H_2SeO_4$
−80	52	$H_2SeO_4.4H_2O$	30	93	H_2SeO_4
−70	54	"	40	94.5	"
−60	58	"	50	96.5	"
−51 m. pt.	67	"	60	100	"

SELENIOUS ACID H_2SeO_3.

SOLUBILITY IN WATER.
(Etard, 1894)

t°.	Gms. H_2SeO_3 per 100 Gms. Solution.	t°.	Gms. H_2SeO_3 per 100 Gms Solution.	t°.	Gms H_2SeO_3 per 100 Gms Solution.
−10	42.2	25	67	60	79.3
0	47.4	30	70.2	70	79.3
+10	55	40	77.5	80	79.3
20	62.5	50	79.2	90	79.4

SELENIOUS ANHYDRIDE (Selenium Dioxide) SeO_2.

SOLUBILITY IN SEVERAL SOLVENTS.
(de Coninck, 1906.)

Solvent.	t°	Gms. SeO_2 per 100 cc Solvent.
Water	11.3–15	38.5
Ethyl Alcohol (93%)	14.1	10.2
Methyl Alcohol	11.8	6.66
Acetone	15.3	4.35
Acetic Acid (Glacial)	12.9	1.11

SILICA SiO_2.

SOLUBILITY IN WATER AND IN AQUEOUS SOLUTIONS OF ACIDS.
(Lenher and Merrill, 1917)

A platinum bottle and stirrer were used. The silica was prepared by adding silicon tetrachloride to water. The gel thus formed was washed until free of HCl and dried between filter papers. Conductivity water was used and equilibrium was reached within 24 hours. The saturated solution was evaporated to dryness in a platinum dish. The residue was weighed and the silica volatilized with HFl + H_2SO_4. The difference was considered to show "the amount of silica which had changed from an unfilterable to a filterable state of division."

Results for Aq. HCl: At 25°.		At 90°.		Results for Aq. H_2SO_4: At 90°.	
Per cent HCl.	Gm SiO_2 per 50 cc Sol	Per cent HCl	Gm. SiO_2 per 50 cc Sol.	Per cent H_2SO_4.	Gm SiO_2 per 50 cc Sol.
0	0.0080	0	0.0213	3.9	0.0211
3	0.00665	2	0.0198	7.3	0.0186
6.3	0.00465	3	0.0186	15.6	0.0112
11.1	0.00245	5.4	0.0152	25.4	0.0058
18.9	0.0008	7.6	0.0115	36	0.0034
25.1	0.0006	10	0.0091	46.9	0.0013
34.6	0.0003	13.6	0.0056	55.6	0.0005
		18.6	0.0029	71	0.0004

At 90°, a slow current of CO_2 through the solutions did not affect the results. Ignited silica reaches equilibrium very slowly as compared with silica gel. The true solubility of ignited silica is probably the same as that of gelatinous silica.

SOLUBILITY OF SILICA IN MELTED CALCIUM CHLORIDE.
(Arndt and Lowenstein, 1909)

t°.	Gms. SiO_2 per 100 Gms. Sat. Solution.
800	2.5
850	3.8
900	5.4
950	7.6

SOLUBILITY IN LEAD, IN ZINC AND IN SILVER.

(Moissan and Siemens, 1904.)

In Lead. t°.	Gm. Si per 100 Gms Lead.	In Zinc. t°.	Gm. Si per 100 Gms. Zinc.	In Silver. t°.	Gm. Si per 100 Gms. Silver.
1250	0.024	600	0.06	970	9.22 (58.02)
1330	0.070	650	0.15	1150	14.89 (27.66)
1400	0.150	730	0.57	1250	19.26 (19)
1450	0.210	800	0.92	1470	41.46 (16)
1550	0.780	850	1.62		

The silicon which crystallized from the saturated solution in silver was found to be incompletely soluble in HF. The figures in parentheses show the percentage soluble in HF in each case.

Freezing-point data for mixtures of silicon tetraphenyl and tin tetraphenyl are given by Pascal (1912).

SILICON IODIDES Si_2I_6, SiI_4.

SOLUBILITY IN CARBON DISULFIDE.

(Friedel and Lachburg, 1869; Friedel, 1869.)

100 gms. CS_2 dissolve 19 gms. Si_2I_6 at 19°.
100 gms. CS_2 dissolve 26 gms. Si_2I_6 at 27°.
100 gms. CS_2 dissolve 2.2 gms. SiI_4 at 27°.

SILICO TUNGSTIC ACID $H_8SiW_{12}O_{42}$.

100 gms. H_2O dissolve 961.5 crystallized silico tungstic acid at 18°, and the solution has Sp. Gr. 2.843.

SILVER Ag.

For equilibrium between metallic Silver and mercury (Silver amalgam) and mixed aqueous solutions of their nitrates, determined for mixtures of the two metals in all proportions, see Reinders, 1906.

SILVER ACETATE CH_3COOAg.

SOLUBILITY IN WATER.

(Nernst, 1889; Arrhenius, 1893; Goldschmidt, 1898; Nauman and Rucker, 1905; Raupenstrauch, 1885; Wright and Thompson, 1884, 1885.)

t°.	Gms. $Ag(C_2H_3O_2)$ per Liter.	t°.	Gms. $Ag(C_2H_3O_2)$ per Liter.	t°.	Gms. $Ag(C_2H_3O_2)$ per Liter.
0	7.22	25	11.2	50	16.4
10	8.75	30	12.1	60	18.9
15	9.4	40	14.1	70	21.8
20	10.4			80	25.2

SOLUBILITY OF SILVER ACETATE IN AQUEOUS SOLUTIONS OF:

Silver Nitrate. Gms. $AgNO_3$ per Liter.	Gms. CH_3COOAg per Liter at: 16° (Nernst).	19.8° (Arrhenius).	Sodium Acetate. Gms. CH_3COONa per Liter.	Gms CH_3COOHg per Liter at: 16° (N., N. and R.).	18.6° (A.).
0	10.05	9.85	0	10.05	9.9
5	8.2	7.9	5	6.3	6.6
10	7.0	6.6	10	4.6	4.9
15	6.4	5.5	15	3.8	4.1
20	5.7	4.5	20	3.3	3.5
30	4.4	...	30	...	2.8
40	3.2	...	40	...	2.4

SOLUBILITY OF SILVER ACETATE IN AQUEOUS SALT SOLUTIONS AT 25°. (Jaques, 1910.)

Aq. Solution of:	Gms Salt. per Liter.	Gms. $AgC_2H_3O_2$ per Liter.	Aq. Solution of:	Gms. Salt per Liter.	Gms $AgC_2H_3O_2$ per Liter.
Water alone	0	11.08	Potassium Acetate	2.22	9.60
Cadmium Acetate	1.15	10.39	" "	22.2	4.43
" "	5.76	8.10	" "	111	2.41
" "	11.52	6.71	" "	222	2.18
" "	57.6	4.33	Silver Nitrate	2.77	9.93
" "	115.2	3.95	" "	5.55	9
Lead Acetate	1.63	10.69	" "	11.10	7.41
" "	8.13	9.45	" "	22.21	5.81
" "	16.26	8.34	Sodium Acetate	1.97	9.27
" "	81.3	7.26	" "	19.7	4.21
" "	162.6	5.99	" "	98.5	2.33
			" "	197	2.07

SOLUBILITY OF SILVER ACETATE IN AQUEOUS SOLUTIONS OF NITRIC ACID AT 25°.
(Hill and Simmons, 1909.)

Normality of Aq. HNO_3.	Per cent HNO_3 in Solvent.	d_{25} of Sat. Sol.	Gms. $AgC_2H_3O_2$ per Liter Sat. Sol.
0	0	1.005	11.13
0.50	3.096	1.072	85.31
1	6.128	1.140	161.9
2	11.757	1.267	307.4
4.02	22.386	1.470	549.3
5.03	27.328	1.561	656
6.44	33.813	1.670	792.2

Results are also given for the solubility of $AgC_2H_3O_2 + AgNO_3$ in Aq. HNO_3 at 25°.

SOLUBILITY OF SILVER ACETATE IN AQUEOUS SOLUTIONS OF SEVERAL COMPOUNDS AT 25°. (Armstrong and Eyre, 1913.)

Aqueous Solution of:	Gms. Compound per 1000 Gms. H_2O.	Gms. $AgC_2H_3O_2$ per 1000 Gms. Sat Sol.	Aqueous Solution of:	Gms Compound per 1000 Gms. H_2O.	Gms $AgC_2H_3O_2$ per 1000 Gms. Sat Sol.
Water	0	11.08	Propyl Alcohol	15	9.88
Acetaldehyde	11	10.13	" "	60	8.03
Paraldehyde	11	8.92	Glycerol	9.21	8.66
"	33	9.16	Glycol	15.5	10.86
Isobutyl Alcohol	66.4	7.55	"	62.1	8.44

SILVER Monochlor**ACETATE** $CH_2ClCOOAg$.

One liter aqueous solution contains 12.97 gms. $CH_2ClCOOAg$ at 16.9°. (Arrhenius, '93.)

SOLUBILITY OF SILVER MONO CHLOR ACETATE AT 16.9° IN AQUEOUS SOLUTIONS OF:

Silver Nitrate.		Sodium Chlor Acetate.	
Gms. $AgNO_3$ per Liter.	Gms. $CH_2ClCOOAg$ per Liter.	Gms $CH_2ClCOONa$ per Liter.	Gms $CH_2ClCOOAg$ per Liter.
0.0	12.97	0.0	12.97
9.6	10.05	3.88	10.05
17.0	7.55	7.77	8.16
		15.53	6.02
		31.07	4.19
		58.26	3.26

SOLUBILITY OF SILVER MONOCHLORO ACETATE IN NITRIC ACID AT 25°.

(Hill and Simmons, 1909.)

Normality of Aq. HNO_3.	Gms. HNO_3 per 100 Gms. Solvent.	d_{25} of Sat. Sol.	Gms. $AgC_2H_2ClO_2$ per Liter.
0	0	1.0095	15.18
0.25	1.564	1.0426	50.33
0.50	3.096	1.0791	91.83
1	6.128	1.1473	167.3
2	11.757	1.2716	310.8
4	22.277	1.4749	549.1
5	27.185	1.5673	659.2

SILVER Dipropyl **ACETATE** $AgC_8H_{15}O_2$.

100 gms. H_2O dissolve 0.123 gm. $AgC_8H_{15}O_2$ at 11.7°, and 0.190 gm. at 72°. (Fürth, 1888.)

SILVER Methyl Ethyl **ACETATE** $Ag.CH_3.CH_2CH(CH_3)COO$.

SILVER Diethyl **ACETATE** $Ag[(C_2H_5)_2CH.COO]$.

SILVER Trimethyl **ACETATE** $Ag(CH_3)_3CCOO$.*

SOLUBILITY OF EACH IN WATER.

(Sedlitzky, 1887; Keppish, 1888; Stiassny, 1891.)

t°.	Gms per 100 Gms H_2O			t°.	Gms per 100 Gms. H_2O.		
	$Ag.C_6H_9O_2$.	$AgC_6H_{11}O_2$.	$AgC_5H_9O_2$.*		$AgC_6H_9O_2$.	$AgC_6H_{11}O_2$.	$AgC_5H_9O_2$.*
0	1.112	0.402	1.10	50	1.602	0.536	1.47
10	1.126	0.413	1.15	60	1.827	0.585	1.57
20	1.182	0.432	1.22	70	2.093	0.643	1.68
30	1.280	0.458	1.22	80	2.402	...	1.80
40	1.420	0.494	1.37				

SILVER ARSENATE Ag_3AsO_4.

One liter H_2O dissolves 0.0085 gm. Ag_3AsO_4 at 20°. See Note, p. 608. (Whitby, 1910.)

SILVER ARSENITE Ag_3AsO_3.

One liter H_2O dissolves 0.0115 gm. Ag_3AsO_3 at 20°. See Note, p. 608. (Whitby, 1910.)

SILVER BENZOATE C_6H_5COOAg.

One liter of aqueous solution contains 1.763 gms. C_6H_5COOAg at 14.5°, and 2.607 gms. at 25°. (Holleman, 1893; Noyes and Schwartz, 1898.)

SOLUBILITY OF SILVER BENZOATE AT 25° IN AQUEOUS SOLUTIONS OF:

Nitric Acid (N. and S.). Gms. Mols. per Liter.		Nitric Acid (N. and S.). Gms. per Liter.		Chloracetic Acid (N. and S.). Gms. Mols per Liter		Chloracetic Acid (N. and S.). Gms. per Liter.	
HNO_3.	C_6H_5COOAg.	HNO_3.	C_6H_5COOAg.	$CH_2ClCOOH$.	C_6H_5COOAg	$CH_2ClCOOH$.	C_6H_5COOAg.
0	0.01144	0	2.607	0	0.01144	0	2.607
0.004435	0.01395	0.280	3.195	0.00394	0.01385	0.371	3.172
0.00887	0.01698	0.559	3.889	0.00787	0.01612	0.744	3.691
0.00892	0.01715	0.562	3.926	0.01574	0.02093	1.487	4.792
0.01774	0.02324	1.118	5.321				
0.02674	0.03071	1.686	7.031				

One liter of cold alcohol dissolves 0.169 gm. C_6H_5COOAg; one liter of boiling alcohol dissolves 0.465 gm. (Liebermann, 1902.)

SILVER BORATE $AgBO_2$.

One liter of aqueous solution contains about 9.05 gms. $AgBO_2$ at 25°. (Abegg and Cox, 1903.)

SILVER BROMATE $AgBrO_3$.

SOLUBILITY IN WATER.

t°.	Gms. $AgBrO_3$ per Liter.	Authority.
20	1.586	(Böttger, 1903.)
24.5	1.911	(Noyes, 1900)
25	1.68	(Longi, 1883)
27	1.71	(Whitby, 1910, see note, p. 608.)
25	1.949	(Hill, 1917.)

SOLUBILITY OF SILVER BROMATE IN AQUEOUS ACETIC ACID AT 25°.
(Hill, 1917.)

Normality of Aq. Acetic Acid.	Gms. $AgBrO_3$ per Liter.	Normality of Aq. Acetic Acid.	Gms. $AgBrO_3$ per Liter.
0.0498	1.9429	0.4988	1.863
0.0997	1.9379	0.9975	1.8013
0.1995	1.9206	1.8721	1.6178

SOLUBILITY OF SILVER BROMATE IN AQUEOUS AMMONIA AND NITRIC ACID SOLUTIONS AT 25°.
(Longi, 1883.)

Solvent.		Gms $AgBrO_3$ per 1000 cc. Sol.	Gms $AgBrO_3$ per 1000 Gms Sol.
Ammonia	Sp. Gr. 0.998 = 5%	35.10	35.54
Ammonia	Sp. Gr. 0.96 = 10%	443.6	462.5
Nitric Acid	Sp. Gr. 1.21 = 35%	3.81	3.12

SOLUBILITY OF SILVER BROMATE AT 24.5° IN AQUEOUS SOLUTIONS OF:

Silver Nitrate (Noyes). Normal Content.		Gms per Liter.		Potassium Bromate (N.). Normal Content.		Gms. per Liter.	
$AgNO_3$.	$AgBrO_3$.	$AgNO_3$.	$AgBrO_3$.	$KBrO_3$.	$AgBrO_3$.	$KBrO_3$.	$AgBrO_3$.
0 0	0.0081	0 0	1.911	0.0	0.0081	0.0	1.911
0.0085	0.0051	1.445	1.203	0.0085	0 00519	1.42	1.225
0.0346	0.0022	5.882	0 510	0.0346	0.00227	5.78	0.536

SILVER BROMIDE AgBr.

SOLUBILITY IN WATER.

t°.	Gms. AgBr per Liter.	Authority.
20	0.000084	(Böttger — Z. physik. Ch. 46, 602, '03.)
25	0.000137	(Abegg and Cox — Z. physik. Ch. 46, 11, '03.)
100	0.00370	(Böttger — Z. physik. Ch. 56, 93, '06)

(See also Holleman — Z. physik. Ch. 12, 129, '93, Kohlrausch — *Ibid.* 50, 365, '05.)

SOLUBILITY OF SILVER BROMIDE IN AQUEOUS AMMONIA SOLUTIONS.
(Longi — Gazz. chim. ital. 13, 87, '83; at 80°, Pohl — Sitzber. Akad. Wiss. Wien, 41, 267, '60.)

Solvent.	Gms AgBr at 12° per 1000 cc. Solvent.	Gms AgBr at 12° per 1000 Gms. Solvent.	Gms. AgBr at 80° per 1000 Gms. Solvent.
Ammonia Sp. Gr. 0.998 = 5%	0.114	0.114	...
Ammonia Sp. Gr. 0.96 = 10%	3.33-4.0	3.47	...
Ammonia Sp. Gr. 0.986	...	...	0.51* 1.0†

* Dried AgBr. † Freshly pptd.

SOLUBILITY OF SILVER BROMIDE IN AQUEOUS AMMONIA SOLUTIONS.

Results at 15°. (Bodländer, 1892.)			Results at 25°. (Bodländer and Fittig, 1901–02.)		Results at 25°. (Whitney and Melcher, 1903.)	
$d_{15.5}$ of Sat. Sol.	Gms. Mols. per Liter. NH_3.	Ag_2Br_2.	Gms. Mols. per 1000 Gms. H_2O. NH_3.	AgBr.	Concentration per Liter. G. Mols. NH_3.	G. Atoms Ag.
0.9932	1.085	0.0011	0.1932	0.00060	0.0764	0.000276
0.9853	2.365	0.0031	0.3849	0.00120	0.115	0.000391
0.9793	3.410	0.0050	0.7573	0.00223	0.268	0.000941
0.9720	4.590	0.0074	1.965	0.00692	0.273	0.00107
0.9655	5.725	0.0101	3.024	0.01163	0.450	0.00170
			5.244	0.02443	0.497	0.00159

SOLUBILITY OF SILVER BROMIDE IN AQUEOUS SOLUTIONS OF:

Ammonia at 0°. (Jarry, 1899) Grams per 100 cc. Solution. NH_3 Gas.	AgBr.	NH_3 Gas.	AgBr.	Monomethyl Amine at 11.5°. (Jarry) Gms. per 100 cc. Solution. NH_2CH_3.	AgBr.
3.07	0.080	26.27	1.067	11.01	0.07
4.88	0.096	31.26	1.568	13.17	0.12
6.69	0.172	33.89	1.987	15.13	0.16
8.29	0.212	36.52	2.669	17.97	0.28
11.51	0.349	37.22	2.888	32.58	0.55
15.32	0.557	37.70	2.930	35.62	0.73
18.09	0.722	39.26	2.892	43.11	1.27
19.53	0.741	39.95	2.852	48.44	2.89

SOLUBILITY OF SILVER BROMIDE IN AQUEOUS SOLUTIONS OF METHYL AMINE AND OF ETHYL AMINE AT 25°.

(Bödlander and Eberlein, 1903; Wuth, 1902.)

In Methyl Amine. Mols. per Liter. Total Base.	AgBr.	Free Base *	In Ethyl Amine. Mols per Liter. Total Base.	AgBr	Free Base.*
1.017	0.0025	1.012 (B. & E.)	0.483	0.00231	0.478 (B. & E.)
0.508	0.0013	0.505 (B. & E.)	0.200	0.00097	0.198 "
0.203	0.00049	0.202 (B. & E., W.)	0.100	0.000475	0.099 "
0.102	0.00026	0.102 (B. & E.)	0.103	0.000711	... (W.)
0.0947	0.00041	... (W.)	0.06572	0.000258	... "
0.051	0.00012	0.051 (B. & E.)	0.05512	0.000193	... "
0.04	0.00034	... (W.)	0.03942	0.000137	... "
0.02	0.00026	... (W.)	0.01272	0.0000867	... "

* The free base is found by subtracting from the total base two mols. of base for each atom of dissolved Ag.

SOLUBILITY OF SILVER BROMIDE IN AQUEOUS SOLUTIONS OF MERCURIC NITRATE AT 25°.

(Morse, 1902.)

Mols. $HgNO_3$-(HNO_3) per Liter.	Mols. AgBr per Liter.	Gms. AgBr per Liter.	Mols. $HgNO_3$-(HNO_3) per Liter.	Mols. AgBr per Liter.	Gms. AgBr per Liter.
1	0.03660	6.878	0.025	0.00459	0.863
0.10	0.00873	1.640	0.0125	0.00329	0.618
0.05	0.00639	1.200	0.0100	0.00306	0.575

Since HNO_3 was present in all cases, its influence on the solubility was examined. It was found that no appreciable differences were obtained with concentrations varying between 0.1 and 2 normal HNO_3. Both crystallized and amorphous silver bromide gave identical results.

SOLUBILITY OF SILVER BROMIDE IN AQUEOUS SALT SOLUTIONS.
(Mees and Piper, 1912.)

Aqueous Solution.	t°.	Gms. AgBr per Liter.
Aq. 1 per cent Sodium Thiosulfate	?	2.06
" " Ammonium Thiocyanate	"	0.03
" " Ammonium Carbonate	"	0.004
" " Sodium Sulfate	"	0.055
" " Thiocarbamide	"	1.49

SOLUBILITY OF SILVER BROMIDE IN AQUEOUS SALT SOLUTIONS.
(Valenta, 1894, see also Cohn, 1895)

Salt Solution.	t°.	Gms. AgBr per 100 Gms. Aq Solution of Concentration: 1:100.	5:100.	10:100.	15:100.	20:100.
Sodium Thio Sulphate	20	0.35	1.90	3.50	4.20	5.80
" " Calc. by Cohn	20	0.50	2.40	4.59	6.58	8.40
Sodium Sulphite	25	...	...	0.04	..	0.08
Potassium Cyanide	25	...	6.55	...	...	...
" " Calc. by Cohn	25	...	6.85	...	...	...
Potassium Sulphocyanide	25	...	...	0.73	...	...
Ammonium Sulphocyanide	20	...	0.21	2.04	5.30	...
Calcium Sulphocyanide	25	...	...	0.53	...	...
Barium Sulphocyanide	25	...	...	0.35	...	...
Aluminum Sulphocyanide	25	...	...	4.50	...	...
Thio Carbamide	25	...	...	1.87	...	...
Thio Cyanime	25	0.08	0.35	0.72	...	...

NOTE. — Cohn shows that the lower results obtained by Valenta are due to the excess of solid AgBr used and the consequent formation of the less soluble di salt, $3(AgS_2O_3Na)_2$, instead of the more soluble tri salt, $(AgS_2O_3Na)_2Na_2S_2O_3$.

100 cc. H_2O containing 10 per cent of normal mercuric acetate, $Hg(C_2H_3O_2)_2$ + Aq., dissolve 0.0122 gm. AgBr at 20°.

100 gms. NaCl in conc. aq. solution dissolve 0.474 gm. AgBr at 15°.

100 gms. NaCl in 21 per cent solution dissolve 0.182 gm. AgBr at 15°.

100 gms. KBr in conc. solution dissolve 3.019 gms. AgBr at 15°.

95 gms. NaCl + 10 gms. KBr in conc. aq. solution dissolve 0.075 gm. AgBr at 15°. (Schierholz, 1890.)

SOLUBILITY OF SILVER BROMIDE IN AQUEOUS POTASSIUM BROMIDE AT 25°.
(Hellwig, 1900)

Mols. KBr per Liter	2.76	3.68	4.18	4.44	4.864
Gms. KBr per Liter	2.20	7.50	13.50	17.95	26.44

SOLUBILITY OF SILVER BROMIDE IN AQUEOUS SOLUTIONS OF SODIUM SULFITE.

Results at Room Temperature (?). (Mees and Piper, 1912)

Results at 25°. (Luther and Leubner, 1912a.)

Gms. per Liter. Na_2SO_3.	AgBr.	Gms per Liter. Na_2SO_3	AgBr.	Gms. Formula Weights per Liter. SO_3''	Ag'.
0.08	0.000746	4.85	0.0329	0.232	0.0025
0.17	0.00219	9.47	0.05264	0.406	0.0023
0.30	0.00393	17.65	0.116	0.448	0.0023
0.59	0.00448	38.2	0.265	0.466	0.0053
1.13	0.00865	70.75	0.57	0.474	0.0055
2.08	0.01585	83.75	0.79	0.675	0.0084

SOLUBILITY OF SILVER BROMIDE IN AQUEOUS SOLUTIONS OF SODIUM THIOSULFATE AT 35°.

(Richards and Faber, 1899.)

Gms. Cryst. Na Thiosulfate per Liter.	Gms. AgBr Dissolved per Gm. of Thiosulphate.	Mols. AgBr Dissolved per Mol. of $Na_2S_2O_3$.
100	0.376	0.496
200	0.390	0.515
300	0.397	0.524
400	0.427	0.564

100 cc. of 3 *n* $AgNO_3$ solution dissolve 0.04 gm. AgBr at 25°. (Hellwig, 1900.)

Fusion-point data for mixtures of AgBr + AgCl and AgBr + AgI are given by Mönkemeyer (1906). Results for AgBr + NaBr are given by Sandonnini and Scarpa (1913).

SILVER BUTYRATE C_3H_7COOAg.

SILVER (Iso)BUTYRATE $(CH_3)_2CHCOOAg$.

SOLUBILITY OF EACH SEPARATELY IN WATER.

(Goldschmidt, 1898; Arrhenius, 1893; Raupenstrauch, 1885.)

t°.	Gms. per 100 Gms. H_2O. Butyrate	Gms. per 100 Gms. H_2O. Iso Butyrate.	t°.	Gms. per 100 Gms. H_2O. Butyrate.	Gms. per 100 Gms. H_2O. Iso Butyrate.
0	0.363	0.796	30	0.561	1.060 (1.1022)
10	0.419	0.874	40	0.647	1.176 (R.)
17.8	0.432 (A.)	...	50	0.742	1.313
18.8	0.445 (A.)	...	60	0.848	...
20	0.484	0.961 (0.9986)	70	0.964	1.670
25	...	... (1.0442)	80	1.14	1.898

SOLUBILITY OF SILVER BUTYRATE IN AQ. SOLUTIONS OF SILVER ACETATE, SILVER NITRATE AND OF SODIUM BUTYRATE.

(Arrhenius, 1893)

In Silver Acetate at 17.8°. G. Mols. per Liter. CH_3COOAg.	G. Mols. per Liter. C_3H_7COOAg.	Grams per Liter. CH_3COOAg.	Grams per Liter. C_3H_7COOAg.	In Silver Nitrate at 18.8°. G. Mols. per Liter. $AgNO_3$.	G. Mols. per Liter. C_3H_7COOAg.	Grams per Liter. $AgNO_3$.	Grams per Liter. C_3H_7COOAg.
0.0	0.0221	0.0	4.32	0.0	0.0228	0.0	4.445
0.0270	0.0139	4.51	2.71	0.0667	0.0078	11.33	1.521
0.0506	0.0103	8.45	2.01	0.100	0.0062	17.00	1.209

In Sodium Butyrate at 18.2°.

G. Mols. per Liter. C_3H_7COONa.	G. Mols. per Liter. C_3H_7COOAg.	Grams per Liter. C_3H_7COONa.	Grams per Liter. C_3H_7COOAg.	G. Mols. per Liter. C_3H_7COONa.	G. Mols. per Liter. C_3H_7COOAg.	Grams per Liter. C_3H_7COONa.	Grams per Liter. C_3H_7COOAg.
0.0	0.0224	0.0	4.363	0.0658	0.0091	7.24	1.774
0.0066	0.0199	0.73	3.881	0.1315	0.0060	14.47	1.170
0.0164	0.0169	1.81	3.296	0.263	0.0040	28.96	0.780
0.0329	0.0131	3.62	2.555	0.493	0.0027	54.28	0.526

SILVER CAPROATES $Ag(C_6H_{11}O_2)$.

SOLUBILITY OF EACH SEPARATELY IN WATER.

(Keppish, 1888; Stiassny, 1891; Kulisch, 1893; König, 1894; Altschul, 1896)

Results in terms of gms. salt per 100 gms. H_2O.

t°.	Normal Caproate $CH_3(CH_2)_4COOAg$		2 Methyl Pentan 4 Acid $CH_3CH.CH_3.(CH_2)_2COOAg$.	Methyl 3 Pentan Acid 4 $CH_3CH_2.CHCH_3CH_2COOAg$.	4 Methyl Pentan 4 Acid $CH_3(CH_2)_2CH(CH_3)COOAg$
0	0.076 (A.)	0.078 (Keppish)	0.168 (König)	0.880 (Kulish)	0.510 (Stiassny)
10	0.085	0.089	0.162	0.858	0.528
20	0.100	0.107	0.163	0.849	0.550
30	0.123	0.131	0.170	0.854	0.574
40	0.154	0.161	0.183	0.871	0.602
50	0.193	0.198	0.203	0.902	0.632
60	0.240	0.243	0.229	0.946	0.666
70	0.295	0.288	0.263	1.003	0.702
80	0.354	...	0.300	1.073	0.742
90	...	...	0.347	1.157	...

SILVER CARBONATE Ag_2CO_3

SOLUBILITY IN WATER.

t°.	Gms. Ag_2CO_3 per Liter.		Authority.
15	0.031		(Kremers, 1852)
25	0.033	(0.00012 gm. atoms Ag.)	(Abegg and Cox, 1903)
25	0.032	(by potential measurement)	(Spencer and Le Pla, 1909.)
100	0.50		(Joulin, 1873)
15	0.85	(in H_2O sat. with CO_2)	(Johnson, 1886)

SILVER CHLORATE $AgClO_3$.

100 gms. cold water dissolve 10 gms. $AgClO_3$ (Vauquelin); 20 gms. $AgClO_3$ (Wachter).

SILVER CHLORIDE AgCl.

SOLUBILITY IN WATER.

(A large number of determinations are quoted by Abegg and Cox, 1903; see also Kohlrausch, 1904–05; Böttger, 1903, 1906)

t°.	14°.	20°.	25°.	42°.	100°.
Gms. AgCl per Liter	0.0014	0.0016	0.0020	0.0040	0.0218

More recent determinations are as follows:

t°.	Gms AgCl per Liter	Method	Authority.
10	0.00089	Conductivity	(Kohlrausch, 1908.)
18	0.00150	Conductivity	(Melcher, 1910.)
21	0.00154	Colorimetric (See Note, p. 608)	(Whitby, 1910)
25	0.00172	Analytical	(Glowczynski, 1914)
50	0.00523	Conductivity	(Melcher, 1910.)
100	0.02107	"	(Melcher, 1910.)
100	0.0217	Colorimetric	(Whitby, 1910.)

Note in the case of determination by Glowczynski, one liter of sat solution was treated with freshly distilled ammonia and evaporated to dryness in a platinum dish The residue was dissolved in strong ammonia and again evaporated. The residue then dissolved in 5–6 cc of 0.05 *n* KCN and the silver separated electrolytically, dissolved in HNO_3 and titrated with 0.01 *n* NH_4SCN.

Comparative determinations of the solubilities of AgCl, AgSCN, AgBr and AgI in water at 25°, showed that if the solubility of AgCl be taken as 1, that of AgSCN is 0.0748, that of AgBr is 0.0550 and that of AgI is 0.00077. (Hill, 1908.)

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS AMMONIA SOLUTIONS AT 25°.

(Whitney and Melcher, 1903.)		(Straub, 1911.)		
Gm. Mols. NH_3 (total) per Liter.	Gm. Atoms Ag per Liter.	Gm. Mols. NH_3 (total) per 1000 Gms. H_2O.	Gm. Atoms Ag per 1000 Gms. H_2O.	Solid Phase.
0.0282	0.00141	0.0428	0.025	AgCl
0.0288	0.00149	1.688	0.1308	"
0.0590	0.00304	3.782	0.372	"
0.118	0.00621	3.945	0.378	"
0.253	0.0140	5.10	0.574	"
0.397	0.0227	5.33	0.609	"
0.428	0.0249	5.545	0.633	"
0.818	0.0514	6.26	0.754	" $+2AgCl.3NH_3$
0.863	0.0541	6.52	0.775	$2AgCl.3NH_3$
0.896	0.0569	8.28	0.848	"
0.909	0.0584	11.78	0.980	"
0.961	0.0616	12.68	1.030	"
1.991	0.147	12.96	1.090	"
2.042	0.151	14.47	1.039	"

Additional data for the above system at 25° are given by Bodländer and Fittig (1901–02). These authors also give results showing the effect of KCl and of $AgNO_3$ on the solubility of AgCl in aqueous ammonia. Determinations at 15° are given by Bodländer (1892).

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF:

Ammonia at 0°. (Jarry, 1899)				Monomethyl Amine at 11.5°. (Jarry)	
Gms. per 100 Gms. Solution.				Gms. per 100 Gms Solution.	
NH_3 Gas.	AgCl.	NH_3 Gas.	AgCl.	NH_2CH_3.	AgCl.
1.45	0.49	28.16	6.50	1.78	0.16
2.94	1.36	29.80	7.09	4.44	0.62
5.60	3.44	30.19	7.25	5.51	0.83
6.24	4	32.43	5.87	7.66	1.32
11.77	4.68	34.56	4.77	13.70	3.29
16.36	5.18	37.48	3.90	18.69	5.43
				36.69	9.93

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF AMMONIA.

(Longi, 1883; at 25°, Valenta, 1894; at 80°, Pohl, 1860.)

Solvent.	t°.	Gms. AgCl per 100 Gms. Solvent.
Aq. Ammonia of 0.998 Sp. Gr. = 5%	12	0.233
" 0.96 Sp. Gr. = 10%	18	7.84
" 0.986 Sp. Gr.	80	1.49
" = 3%	25	1.40
" = 15%	25	7.58

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF METHYL AMINE AND OF ETHYL AMINE AT 25°.

(Bodländer and Eberlein, 1903; Wuth, 1902; Euler, 1903)

Results for Methyl Amine. Mols. per Liter.

Total Base.	AgCl.	Free Base.
1.017	0.0387	0.940 (B. & E.)
0.93	0.0335	... (E.)
0.508	0.0178	0.472 (B. & E.)
0.203	0.0068	0.189 "
0.102	0.0036	0.0050 "
0.195	0.00048	... (W.)
0.074	0.00042	... "
0.020	0.00030	... "

Results for Ethyl Amine. Mols. per Liter.

Total Base.	AgCl.	Free Base
0.483	0.0314	0.420 (B. & E.)
0.200	0.0115	0.177 "
0.100	0.0062	0.088 "
0.094	0.0048	... (E.)
0.050	0.0029	0.044 (B. & E.)
0.103	0.00824	... (W.)
0.0551	0.000235	... "
0.0127	0.000114	... "

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE.

(Schierholz, 1890; see also Vogel, 1874; Hahn, 1877)

Solubility at 15°. Gms per 100 Gms Solution.

NH_4Cl	AgCl
10	0.0050
14.29	0.0143
17.70	0.0354
19.23	0.0577
21.91	0.110
25.31	0.228
28.45	0.340 (24.5)
Sat. at ord. temp.	0.157

Solubility at Different Temperatures. Gms. per 100 Gms. Solution.

t°.	NH_4Cl.	AgCl
15	26.31	0.276
40	"	0.329
60	"	0.421
80	"	0.592
90	"	0.711
100	"	0.856
110	"	1.053

Sp. Gr. of 26.31% NH_4Cl solution at 15° = 1.08.

One liter aq. sol. containing 0.00053 gm. NH_4Cl dissolves 0.001604 gm. AgCl at 25°.

One liter aq. sol. containing 0.00530 gm. NH_4Cl dissolves 0.002379 gm. AgCl at 25°. (Glowczynski, 1914)

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF AMMONIUM CHLORIDE AT 25°. (Forbes, 1911.)

Gms. Equiv per Liter NH_4Cl.	Ag	Gms Equiv. per Liter NH_4Cl	Ag.	Gms Equiv per Liter. NH_4Cl	Ag
0.513	0.000042	2.566	0.001425	4.777	0.0135
0.926	0.000113	2.918	0.002160	4.902	0.01492
1.141	0.000172	3.162	0.002795	5.503	0.02404
1.574	0.000365	3.510	0.004029	5.764	0.03017
2.143	0.000842	4.363	0.009353		

These determinations were made by gradually adding 0.25 *n* and 0.01 *n* $AgNO_3$ to the chloride solution and observing the point of initial opalescence

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF ALUMINIUM AND AMMONIUM SALTS. (Valenta; see also Cohn, 1895)

Aq. Salt Solution.	t°.	Gms. AgCl per 100 Gms Solvent of Concentration: 1 : 100.	5 : 100	10 : 100.
Aluminium Thiocyanate	25	...	...	2.02
Ammonium Carbonate	25	...	...	0.05
" Thiocyanate	20	...	0.08	0.54
" Thiosulfate	20	0.57	1.32	3.92
" "	Calc. by Cohn*	0.64	3.07	5.86

* See Note, p. 603.

Solubility of Silver Chloride in Aqueous Solutions of Barium Chloride and of Calcium Chloride.

(Forbes, 1911.)

Aq. Solution of:	t°.	Gms. Equiv. per Liter. $\frac{BaCl_2}{2}$.	Ag.	Aq. Solution of:	t°.	Gms. Equiv. per Liter. $\frac{CaCl_2}{2}$.	Ag.
Barium Chloride	25	1.248	0.000186	Calcium Chloride	25	3.264	0.001463
"	25	1.610	0.000339	"	25	3.737	0.002182
"	25	2.676	0.001274	"	25	4.033	0.002802
"	25	3.260	0.002366	"	25	4.538	0.004175
		$\frac{CaCl_2}{2}$		"	25	5.005	0.005823
Calcium Chloride	25	1.748	0.000289	"	1	3.512	0.000964
"	25	2.201	0.000501	"	25	3.320	0.001514
"	25	2.741	0.000900	"	35	3.221	0.001806

Solubility of Silver Chloride in Aqueous Solutions of Hydrochloric Acid at 25°.

(Forbes, 1911.)

Gms Equiv per Liter HCl.	Ag	Gms Equiv per Liter HCl	Ag	Gms Equiv. per Liter HCl.	Ag.
0.649	0.000032	2.149	0.000374	4.182	0.002147
1.300	0.000126	2.975	0.000814	4.735	0.003168
1.911	0.000266	3.576	0.001358	5.508	0.005126

The determinations of Forbes were made by gradually adding 0.25 *n* and 0.01*n* $AgNO_3$ to the chloride solution and observing the point of initial opalescence.

One liter of 1 per cent aq. HCl dissolve	0.0002 gm. AgCl at 21°.	(Whitby, '10)
" " 5 " " "	0.0033 " "	"
" " 10 " " "	(0.0555)0.0740 " "	"

NOTE.—The determinations of Whitby were made by a colorimetric method which was based upon the observation that the color produced by heating a solution of a silver salt with sodium hydroxide and certain organic compounds such as dextrin, glycerol, starch, sugar, etc., is proportional to the amount of silver present.

Solubility of Silver Chloride in Aqueous Hydrochloric Acid Solutions at Ordinary Temperature.

(Pierre, 1847; Vogel)

Solvent.	Gms. AgCl per Liter.	Solvent.	Gms. AgCl per Liter.
Conc. HCl + Aq.	5	100 vol. sat. HCl + 10 vol. H_2O	0.56
1 vol. Conc. HCl + 1 vol. H_2O	1 6	" + 20 "	0.18
Sat. HCl Sp. Gr. 1.165	2 98	" + 30 "	0.09
" " (at b. pt.)	5.60	" + 50 "	0.035

Solubility of Silver Chloride in Aqueous Solutions of Mercuric Nitrate at 25°.

(Morse, 1902)

Mols. $HgNO_3(HNO_3)$ per Liter.	Mols. AgCl per Liter.	Gms. AgCl per Liter.	Mols. $HgNO_3(HNO_3)$ per Liter.	Mols. AgCl per Liter.	Gms. AgCl per Liter.
0.0100	0.00432	0.620	0.050	0.00914	1.310
0.0125	0.00499	0.715	0.100	0.01395	2
0.025	0.00690	0.990	1	0.04810	6.896

Since HNO_3 was present in all cases, its influence on the solubility was examined. It was found that no appreciable differences were obtained with concentrations varying between 0.1 and 2 normal HNO_3. Both crystallized and amorphous silver chloride gave identical results.

Solubility of Silver Chloride in Aqueous Salt Solutions.

(Vogel; Hahn; Valenta)

Salt Solution.	Conc. of Salt.	t°.	Gms. AgCl per 100 Gms. Solution.	
Barium Chloride	27.32%	24.5	0.057	(H.)
Barium Chloride	saturated	ord. temp.	0.014	(Vg.)
Barium Sulphocyanide	10 : 100	25	0.20	(Vl.)
Calcium Sulphocyanide	10 : 100	25	0.15	(Vl.)
Calcium Chloride	41.26%	24.5	0.571	(H.)
Calcium Chloride	saturated	ord. temp.	0.093	(Vg.)
Copper Chloride	"	24.5	0.053	(H.)
Ferrous Chloride	"	"	0.169	(H.)
Ferric Chloride	"	"	0.006	(H.)
Manganese Chloride	"	"	0.013	(H.)
Magnesium Chloride	50 : 100	25	0.50	(Vl.)
Magnesium Chloride	36.35%	24.5	0.531	(H.)
Magnesium Chloride	saturated	ord. temp.	0.171	(Vg.)
Strontium Chloride	"	"	0.088	(Vg.)
Zinc Chloride	"	24.5	0.0134	(H.)
Potassium Chloride	"	ord. temp.	0.0475	(Vg.)
Potassium Chloride	24.95%	19.6	0.0776	(H.)
Potassium Cyanide	5 : 100	25	2.75	(Vl.)
Potassium Cyanide	5 : 100	25	5.24	(Cohn*)
Potassium Sulphocyanide	10 : 100	25	0.11	(Vl.)
Sodium Chloride	saturated	ord. temp.	0.095	(Vg.)
Sodium Chloride	25.95%	19.6	0.105	(H.)

* See Note, p. 603

Solubility of Silver Chloride in Aqueous Solutions of Nitric Acid at 25°.

(Glowczynski, 1914.)

Mols. per Liter.		Gms. per Liter	
HNO_3	AgCl	HNO_3.	AgCl
0.0005	$1.15.10^{-5}$	0.0315	0.001647
0.001	$1.19.10^{-5}$	0.063	0.001705
0.01	$1.24.10^{-5}$	0.630	0.00176
0.30	$1.57.10^{-5}$	18.9	0.00225
1.50(?)	$1.71.10^{-5}$	94.5	0.00245

Solubility of Silver Chloride in Aqueous Solutions of Potassium Chloride at 25°.

(Forbes, 1911)

Gms. Equiv. per Liter.		Gms. Equiv. per Liter.	
KCl.	Ag.	KCl.	Ag.
1.111	0.000141	2.850	0.001845
1.425	0.000235	3.081	0.002435
1.713	0.000391	3.424	0.003602
2.022	0.000616	3.843	0.005725
2.396	0.001050	3.325	0.001734 (at 1°)
2.628	0.001390	2.955	0.002786 (at 35°)

(Glowczynski, 1914.)

Mols per Liter		Gms per Liter.	
KCl.	AgCl	KCl.	AgCl
$3.16\ 10^{-5}$	$1.28.10^{-5}$	0.00236	0.001836
$6\ 32.10^{-5}$	$1\ 52\ 10^{-5}$	0 00471	0.002178
$2.0.10^{-4}$	$2.13.10^{-5}$	0.01491	0.003052
$4.0.10^{-4}$	$2.24.10^{-5}$	0 02984	0.003209

The determinations of Glowczynski were made by the method described in Note, on p. 605. The determinations of Forbes were made by gradually adding 0.25 *n* and 0.01 *n* $AgNO_3$ to the chloride solution and observing the point of initial opalescence.

One liter 4 *n* aq. KCl dissolves 0.00637 gm. mol. = 0.915 gm. AgCl at 25°. (Hellwig, 1900.)

Solubility of Silver Chloride in Aqueous Solutions of Potassium Chloride at 15°.

(Schierholz — Sitzber. K. Akad. Wiss. (Vienna) 101, 2b, 8, '90.)

Grams per 100 Grams Solution.		Grams per 100 Grams Solution.	
KCl	AgCl.	KCl.	AgCl.
10.0	0.000	22.47	0.045
14.29	0.004	24.0	0.072
16.66	0.008	25.0	0.084
20.00	0.020		

Sp. Gr. of 25% KCl sol., = 1.179

Mixtures of Silver Chloride and Silver Hydroxide in Equilibrium with Aq. Potassium Hydroxide Solutions at 25°.

(Noyes and Kohr — J. Am Ch. Soc. 24, 1144, '02)

Normality of KOH.	Millimols per Liter.		Grams per Liter		
	KCl.	KOH	KCl.	KOH.	AgCl.
0.333	3.414	347.8	0.255	10.05	0.4896
0.065	0.598	65.0	0.0446	2.00	0.0828

Solubility of Silver Chloride in Aq. Sodium Chloride Solutions.

(Schierholz; Vogel; Hahn.)

Solubility at 15°.

Gms per 100 Gms Solution.	
NaCl.	AgCl.
10.0	0.0025
14.29	0.0071
18.18	0.0182
21.98	0.0439
23.53	0.0706
25.64	0.103
26.31	0.127

Sp. Gr. of 26.31% NaCl sol. = 1.207.

Solubility at Different Temperatures.

t°	Gms. AgCl per 100 Gms. Solution in	
	14% NaCl	26.3% NaCl.
15	0.007	0.128
30	0.011	0.132
40	0.014	0.158
50	0.023	0.184
70	0.042	0.263
80	0.054	0.315
90	0.069	0.368
100	0.090	0.460
109	0.107 (104°)	0.571

Solubility at 20°, 50°, and 90° (Calc. from Original).

(Barlow — J Am. Chem Soc 28, 1446, '06)

Gms. NaCl per 100 cc. Solution.	Gms. AgCl dissolved per 100 cc. Solution at:		
	20°.	50°.	90°.
3.43	0.00018	0.0016	0.0067
4.60	0.00025	0.0025	0.0100
5.75	0.00047	0.0034	0.0135
7.67	0.00125	0.0058	0.0236
11.5	0.0031	0.0124	0.0436
15.3	0.0090	0.0191	0.0732
23.0	0.0313	0.0889	0.1706

Results are also given for the solubility of silver chloride in aqueous sodium chloride solutions containing hydrochloric acid.

Solubility of Silver Chloride in Aqueous Sodium Chloride at 25°.

(Forbes, 1911.)

Gms Equiv. per Liter	
[NaCl].	[Ag] × 10^6.
0.933	0.086
1.190	0.130
1.433	0.184
1.617	0.245
1.871	0.348
2.272	0.570
2.658	0.851
2.841	1.040
3.270	1.583
3.471	1.897
3.747	2.462
3.977	2.879
4.363	3.810
4.535	4.298
5.039	6.039

SOLUBILITY OF SILVER CHLORIDE IN AQ. SODIUM NITRATE SOLUTIONS.

t°.	Gms. per 100 Gms. H_2O. $NaNO_3$.	$AgCl$.	t°.	Gms. per 100 Gms. H_2O. $NaNO_3$.	$AgCl$.
5	0.787	0.00086	15-20	0.393	0.00096
18	0.787	0.00146	"	0.787	0.00133
30	0.787	0.00233	"	2.787	0.00253
45-55	0.787	0.00399		(Mulder)	

One liter aq. 3 n $AgNO_3$ dissolves 0.0056 gm. mols. = 0.8 gm. AgCl at 25°. (Hellwig, 1900.)

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SODIUM SULFITE SOLUTIONS AT 25°.

(Luther and Leubner, 1912.)

Gms. Formula Weight per Liter. SO_3''.	Ag'.	Gms Formula Weight per Liter SO_3''.	Ag'.
0.080	0.011	0.483	0.059
0.106	0.017	0.470	0.070
0.220	0.033	0.652	0.103
0.234	0.036	0.890	0.140
0.478	0.057	0.937	0.142

The AgCl was prepared by precipitating dilute $AgNO_3$ with alkali chloride at the b. pt. The resulting solid corresponded to the granular modification of Stas. About one hour constant agitation was allowed for attainment of equilibrium.

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM THIOSULFATE, ETC.

(Valenta; Cohn, Richards and Faber, 1899)

Salt Solution.	t°.	Gms. AgCl per 100 Gms. Aq. Solutions of Concentration: 1 : 100.	5 : 100	10 : 100	15 : 100	20 : 100.
Sodium Sulfite	25	...	...	0.44	...	0.95
Sodium Thiosulfate	20	0.40	2	4.10	5.50	6.10
" " Calc. by Cohn.*		0.38	1.83	3.50	5.02	6.41
Sodium Thiosulfate	35	...	...	...	...	9.08†
Thiocarbamide	25	...	...	0.83	...	...
Thiocyanimine	25	0.40	1.90	3.90	...	...

* See Note, p. 603. † Gms per 100 cc solution (R and F).

SOLUBILITY OF SILVER CHLORIDE IN AQUEOUS STRONTIUM CHLORIDE AT 25°.

(Forbes, 1911)

Gms Equiv per Liter. $\frac{SrCl_2}{2}$.	$Ag \times 10^6$.	Gms Equiv per Liter $\frac{SrCl_2}{2}$.	$Ag \times 10^6$	Gms Equiv. per Liter. $\frac{SrCl_2}{2}$.	$Ag \times 10^6$.
0.550	0.033	1.818	0.348	3.404	2.018
0.989	0.092	2.140	0.510	4.152	3.594
1.359	0.173	2.476	0.747	5.216	8.174
1.572	0.236	2.992	1.252	5.775	12.040

The determinations were made by gradually adding 0.25 n and 0.01 n $AgNO_3$ to the chloride solution and observing the point of initial opalescence.

One liter of 4.777 n $ZnCl_2$ solution dissolves 0.000364 mol. AgCl at 25°. (Forbes, 1911.)

Fusion-point data are given for the following mixtures.

- AgCl + AgI. (Monkemeyer, 1906)
- AgCl + Ag_2S. (Truthe, 1912; Sandonnini, 1912)
- AgCl + NaCl. (Sackur, 1913; Botta, 1911; Sandonnini, 1911, 1914.)
- AgCl + TlCl. (Sandonnini, 1911, 1914.)

SOLUBILITY OF SILVER CHLORIDE IN PYRIDINE.
(Kahlenberg and Wittich, 1909.)

t°.	Gms. AgCl per 100 Gms. Pyridine.	Solid Phase.	t°.	Gms. AgCl per 100 Gms. Pyridine.	Solid Phase.
−57 Eutec.	...	$AgCl.2C_5H_5N+C_5H_5N$	0	5.35	AgCl
−49	0.77	$AgCl.2C_5H_5N$	10	3.17	"
−35	0.99	"	20	1.91	"
−30	1.36	"	30	1.20	"
−25	1.80	"	40	0.80	"
−22	2.20	"	50	0.53	"
— tr. pt.	2.75	" $+AgCl.C_5H_5N$	60	0.403	"
−20	3.75	$AgCl.C_5H_5N$	70	0.32	"
−18	3.85	"	80	0.25	"
−10	4.35	"	90	0.22	"
− 5	5.05	"	100	0.18	"
− 1	5.60	"	110	0.12	"

SILVER CHROMATE Ag_2CrO_4.

One liter of water dissolves 0.026 gm. Ag_2CrO_4 at 18°, and 0.020 gm. at 25°. (Abegg and Cox, 1903; Kohlrausch, 1904–05.)

One liter H_2O dissolves 0.029 gm. Ag_2CrO_4 at 25°. (Schäfer, 1905.)

One liter of H_2O dissolves 0.0142 gm. Ag_2CrO_4 at 0.26°; 0.0225 gm. at 14.8°, 0.036 gm. at 30.7° and 0.084 gms. at 75°. (Kohlrausch, 1908)

One liter H_2O dissolves 0.0256 gm. at 18°, 0.0341 gm. at 27° and 0.0534 gm. at 50°, determined by a colorimetric method (see Note, p. 608). (Whitby, 1910.)

SOLUBILITY OF SILVER CHROMATE IN AQUEOUS AMMONIA AT 25°.
(Sherrill and Eaton, 1907.)

Mols. NH_4OH per Liter	0.01	0.02	0.04	0.08
Mols. × 10^3 Ag_2CrO_4 per Liter	2.004	4.169	8.595	17.58

SOLUBILITY OF SILVER CHROMATE IN AQUEOUS NITRIC ACID AT 25°.
(Sherrill and Russ, 1907.)

Mols. HNO_3 per Liter.	Milliatoms per Liter. Cr	Ag	Solid Phase.	Mols HNO_3 per Liter.	Milliatoms per Liter. Cr	Ag	Solid Phase.
0.01	3.157	6.315	Ag_2CrO_4	0.06	6.833	...	Ag_2CrO_4
0.015	3.730	...	"	0.07	7.333	...	"
0.02	4.177	8.356	"	0.075	7.477	14.85	" $+Ag_2Cr_2O_7$
0.025	4.567	...	"	0.08	7.260	15.45	"
0.03	5.200	...	"	0.10	5.647	19.01	"
0.04	5.803	11.62	"	0.13	4.293	23.89	"
0.05	6.380	...	"	0.14	3.948	25.63	"

One liter 65% aqueous alcohol dissolves 0.78×10^{-4} gms. equivalents = 0.0129 gm. Ag_2CrO_4 at room temp. (?). (Guerini, 1912.)

SOLUBILITY OF SILVER CHROMATE IN AQUEOUS SOLUTIONS OF NITRATES AT 100°.
(Carpenter, 1886)

Solvent.	Gms. Salt per 100 cc. H_2O.	Gms. Ag_2CrO_4 per 100 cc. Solution.
Water	0	0.064
Sodium Nitrate	50	0.064
Potassium Nitrate	50	0.192
Ammonium Nitrate	50	0.320
Magnesium Nitrate	50	0.256

SILVER (Di) CHROMATE $Ag_2Cr_2O_7$.

One liter of aqueous solution contains 0.00019 gm. mol. or 0.083 gm. $Ag_2Cr_2O_7$ at 15°. (Mayer, 1903.)

SOLUBILITY OF SILVER DICHROMATE IN AQUEOUS NITRIC ACID AT 25°.
(Sherrill and Russ, 1907.)

Mols. HNO_3 per Liter.	Milliatoms per Liter. Cr.	Ag.	Solid Phase.
0	32.20	5.390	$AgCrO_4+Ag_2Cr_2O_7$
0.01	25.06	6.131	" "
0.02	20.21	7.148	" "
0.04	13.59	9.529	" "
0.06	11.10	11.1	$Ag_2Cr_2O_7$
0.08	11.1	11.1	"
0.08+0.1 $AgNO_3$	6.625	...	"

At the lower concentrations some of the dichromate is converted into solid chromate.

SILVER CITRATE $C_6H_5O_7Ag_3$.

100 gms. H_2O dissolve 0.0277 gm. $C_6H_5O_7Ag_3$ at 18°, and 0.0284 gm. at 25°. (Partheil and Hübner, 1903)

SILVER CYANIDE AgCN.

One liter of aqueous solution contains 0.000043 gm. AgCN at 17.5° and 0.00022 gm. at 20° (by Conductivity Method). (Abegg and Cox, Böttger, 1903)

SOLUBILITY OF SILVER CYANIDE IN AQUEOUS AMMONIA SOLUTIONS.
(Longi, 1883)

100 gms. aq. ammonia of 0.998 Sp. Gr. = 5%, dissolve 0.232 gm. AgCN at 12°.
100 gms. aq. ammonia of 0.96 Sp. Gr. = 10%, dissolve 0.542 gm. AgCN at 18°.

One liter aq. 3 *n* $AgNO_3$ dissolves 0.0091 gm. mol. = 1.216 gm. AgCN at 25°. (Hellwig, 1900)

Fusion-point data for mixtures of AgCN + NaCN are given by Truthe (1912).

SILVER FERRICYANIDE Ag_3FeCN_6.

One liter H_2O dissolves 0.00066 gm. Ag_3FeCN_6 at 20°. See Note, p. 608. (Whitby, 1910.)

SILVER SODIUM CYANIDE AgCN.NaCN.

100 gms. H_2O dissolve 20 gms. at 20°, and more at a higher temperature. 100 gms. 85% alcohol dissolve 4.1 gms. at 20°. (Baup, 1858.)

SILVER THALLOUS CYANIDE AgCN.TlCN.

100 gms. H_2O dissolve 4.7 gms. at 0°, and 7.4 gms. at 16°. (Fronmüller, 1878.)

SILVER FLUORIDE $AgF.2H_2O$.

SOLUBILITY IN WATER.
(Guntz and Guntz, Jr., 1914)

t°.	Gms. AgF per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. AgF per 100 Gms. H_2O.	Solid Phase
−14.2 Eutec.	60	Ice+$AgF.4H_2O$	25	179.5	$AgF.2H_2O$
+18.5	165	$AgF.4H_2O$	28.5	215	"
18.65	169.5	" +$AgF.2H_2O$	32	193	"
20	172	$AgF.2H_2O$	39.5	222	" +AgF
24	178	"	108	205	AgF

Two unstable hydrates, $AgF.H_2O$ and $3AgF.5H_2O$ were also obtained.
100 gms. H_2O dissolve 181.8 gms. AgF at 15.8°, $d_{15.8}$ of Sat. Sol. = 2.61. (Gore, 1870.)

SOLUBILITY OF SILVER FLUORIDE IN AQUEOUS SOLUTIONS OF HYDROFLUORIC ACID AT 0° AND AT 24°.

(Guntz and Guntz, Jr., 1914.)

Results: Gms. per 100 Gms. H_2O. AgF.	HF.	Solid Phase.	Results at 24°: Gms. per 100 Gms. H_2O. AgF.	HF.	Solid Phase.
87.5	0.40	$AgF.4H_2O$	178	0	$AgF.2H_2O$
89.4	2.60	"	178.5	1.73	"
93.8	3.97	"	177.65	5.42	"
118.5	9.60	"	179.5	10	"
156	14	" $+AgF.2H_2O$	189.5	13.4	"
159	17.2	$AgF.2H_2O$	191.5	14.3	" +AgF(?)
185	24	"	207	0.15	$3AgF.5H_2O$
189	25.7	AgF	206.2	1.25	"
188	29.5	"	202.5	7.9	"
196	39.8	"	198.6	12.65	"
142.1	52	$AgF.2H_2O$	195.5	11.7	$AgF.H_2O$
121.75	57.2	"	194.5	13	"
94.93	66.57	"	189.5	18.8	$3AgF.5H_2O+AgF$(?)
173.75	0.4	$3AgF\,5H_2O$	193	36.6	AgF
174	3.6	"	193.5	16	

Additional determinations at other temperatures are given.

SILVER FULMINATE $CAg_2(NO_2)CN$.

One liter of aqueous solution contains 0.075 gm. $C_2Ag_2N_2O_2$ at 13°, and 0.180 gm. at 30°. (Holleman, 1896)

SILVER HEPTOATE (Önanthylate) $AgC_7H_{13}O_2$.

SOLUBILITY IN WATER.

(Landau, 1893; Altschul, 1896)

t°.	Gms $AgC_7H_{13}O_2$ per 100 Gms H_2O. (Landau)	(Altschul)	t°.	Gms. $AgC_7H_{13}O_2$ per 100 Gms. H_2O. (Landau)	(Altschul)
0	0.0635	0.0436	50	0.1652	0.0858
10	0.0817	0.0494	60	0.1906	0.1036
20	0.1007	0.0555	70	0.2185	0.1351
30	0.1206	0.0617	80	0.2495	0.1688
40	0.1420	0.0714			

SILVER IODATE $AgIO_3$.

One liter of aqueous solution contains 0.04 gm. or 0.00014 gm. mol. at 18°-20°, and 0.05334 gm. or 0.000189 gm. mol. at 25°.

(Longi; Bottger; Kohlrausch; Noyes and Kohr, 1902.)

The solubility of silver iodate in water, determined by a colorimetric method (see Note, p. 608), was found by Whitby (1910) to be 0.039 gm. $AgIO_3$ per liter at 20°. Determinations reported by Sammet (1905) made by a chain cell method, gave 0.0611 gm. $AgIO_3$ per liter at 25° and 0.1849 gm. at 60°.

One liter of H_2O dissolves 0.0275 gm. $AgIO_3$ at 9.43°, 0.039 gm. at 18.4° and 0.0539 gm. at 26.6°. (Kohlrausch, 1908.)

SOLUBILITY OF SILVER IODATE IN AQUEOUS SOLUTIONS OF AMMONIA AND OF NITRIC ACID AT 25°.

(Longi, 1883.)

100 gms. aq. ammonia of 0.998 Sp. Gr. = 5% dissolve 2.36 gms. $AgIO_3$.
100 gms. aq. ammonia of 0.96 Sp. Gr. = 10% dissolve 45.41 gms. $AgIO_3$.
100 gms. aq. nitric acid of 1.21 Sp. Gr. = 35% dissolve 0.096 gm. $AgIO_3$.

Solubility of Silver Iodate in Aqueous Solutions of Nitric Acid at 25°.

(Hill and Simmons, 1909)

Normality of Aq. HNO_3.	Gms $AgIO_3$ per Liter.	Normality of Aq. HNO_3.	Gms $AgIO_3$ per Liter.
0	0.0503	1	0.2067
0.125	0.0864	2	0.3319
0.250	0.1075	4	0.6985
0.500	0.1414	8	1.587

The solubility of the amorphous modification of $AgIO_3$ is considerably higher than that of the crystalline, but the amorphous product rapidly becomes crystalline and correct results are soon obtained.

SILVER IODIDE AgI.

One liter of aqueous solution contains 0.0000028 gm. AgI at 20°–25°.
(Average of several determinations by Kohlrausch, Abegg and Cox, etc, Holleman gives higher figures)

One liter of water dissolves 0.0000253 gm. AgI at 60°, determined by a chain cell method (Sammet, 1905). This author also gives data for the solubility of AgI in 1 *n* and 0.1 *n* KI solutions at 60°.

Solubility of Silver Iodide in Aqueous Ammonia.

Per cent Concentration of Aq. Ammonia.	*d* of Aq. Ammonia.	t°.	Gms. AgI per Liter.	Authority.
7	0 971	16	0 045	(Ladenburg, 1902)
10	0.960	12	0 035	(Longi, 1883)
20	0.926	16	0.166	(Baubigny, 1908)

Baubigny used a sealed tube and noted the first appearance of crystallization of AgI in mixtures of known compositions.

Solubility of Silver Iodide in Aqueous Mercuric Nitrate at 25°.

(Morse, 1902)

Mols $Hg(NO_3)_2$ per Liter.	Mols AgI per Liter.	Gms AgI per Liter.	Mols $Hg(NO_3)_2$ per Liter	Mols. AgI per Liter.	Gms AgI per Liter
0.010	0.00340	0.800	0.050	0.00740	1.737
0.0125	0.00358	0.841	0.100	0 01161	2 730
0 025	0.00476	1.118	1	0.10700	25.160

Since HNO_3 was present in all cases its influence on the solubility was examined. It was found that no appreciable differences were obtained with concentrations varying between 0.1 and 2 *n* HNO_3. Both crystallized and amorphous silver iodide gave identical results.

Solubility of Silver Iodide in Aqueous Solutions of Potassium Iodide and of Silver Nitrate at 25°.

(Hellwig, 1900.)

In Aq. KI Solutions.			In Aq. $AgNO_3$ Solutions.			
Mols. KI per Liter.	Mols. AgI per Liter.	Gms AgI per Liter.	Mols $AgNO_3$ per Liter.	Mols. AgI per Liter.	Gms AgI per Liter	Solid Phase.
0.335	0.000363	0.0853	0.20	0.000289	0.068	AgI
0.586	0.00218	0.512	0.35	0 000532	0.121	"
0.734	0.0044	1.032	0.50	0.00127	0.299	"
1.008	0.0141	3.32	0.70	0.00362	0.850	"
1.018	0.0148	3.47	1.215	0.0131	3.08	Ag_2INO_3
1.406	0.0535	12.55	1.63	0.0267	6.26	"
1.486	0.0658	15.46	2.04	0.0458	10 9	"
1.6304	0.102	24.01	2.54	0.0678	16.1	$Ag_3I(NO_3)_2$
1.937	0.198	46.42	3.75	0.141	33.2	"
			4.69	0.227	53.2	"
			5.90	0.362	85	"

Solubility of Silver Iodide in Aqueous Salt Solutions.

(Valenta, 1894; Cohn, 1895.)

Aq. Salt. Solution.	t°.	Gms. AgI per 100 Gms. Aq. Sol. of Concentration: 1 : 100.	5 : 100.	10 : 100.	15 : 100.	20 : 100.
Sodium Thiosulfate	20	0.03	0.15	0.30	0.40	0.60
" " Calc. by Cohn.*		0.623	2.996	5.726	8.218	10.493
Potassium Cyanide	25	...	8.28	...	...	...
" " Calc. by Cohn *		...	8.568	...	...	...
Sodium Sulfite	25	...	...	0.01	...	0.02
Ammonium Thiocyanate	20	...	0.02	0.08	0.13	...
Calcium "	25	...	...	0.03	...	...
Barium "	25	...	...	0.02	...	...
Aluminium "	25	...	...	0.02	...	...
Thiocarbamide	25	...	...	0.79	...	...
Thiocyanime	25	0.008	0.05	0.09	...	...

* See Note, p. 603.

Solubility of Silver Iodide in Aqueous Solutions of Sodium Chloride, Potassium Bromide and of Potassium Iodide at 15°.

(Schierholz, 1890)

In Sodium Chloride.

Gms. per 100 Gms Solution NaCl.	AgI.
26.31	0.0244
25.00	0.00072

In Potassium Bromide.

Gms per 100 Gms Solution. KBr	AgI
30.77	0.132

In Potassium Iodide.

Gms. per 100 Gms. Solution. KI.	AgI.
59.16	53.13
57.15	40.0
50.0	25.0
40.0	13.0
33.3	7.33
25.0	2.75
21.74	1.576
20.0	0.80

100 gms. sat. silver nitrate solution dissolve 2.3 gms. AgI at 11°, and 12.3 gms. at b. pt.

100 gms. pyridine dissolve 0.10 gm. AgI at 10°, and 8.60 gms. at 121°.

(von Laszcynski, 1894.)

Solubility of Silver Iodide in Aqueous Sodium Iodide at 25°.

(Krym, 1909)

Gms. per 100 Gms H_2O. NaI.	AgI.	Solid Phase.	Gms per 100 Gms H_2O. NaI	AgI.	Solid Phase.
59.29	21.21	AgI	226	120.9	$AgI.NaI.3\frac{1}{2}H_2O$+NaI
67.47	28.52	"	222.7	112.1	NaI
134.1	99.54	"	214.7	90.84	"
156.9	124.6	"	203.9	59.48	"
179.8	150	" +$AgI NaI 3\frac{1}{2}H_2O$	194.5	31.10	"
196.3	134.8	$AgI.NaI.3\frac{1}{2}H_2O$	185.52	0	"
223.7	122	"			

The above table was calculated from the original results which are expressed in mols. per 1000 mols. H_2O.

Fusion-point data for mixtures of AgI + HgI_2 are given by Steger (1903). Results for AgI + NaI are given by Sandonnini and Scarpa (1913).

SILVER LAURATE, MYRISTATE, PALMITATE and STEARATE

SOLUBILITY OF EACH, DETERMINED SEPARATELY, IN WATER AND OTHER SOLVENTS AT SEVERAL TEMPERATURES.

(Jacobson and Holmes, 1916.)

Solvent.	t°.	Gms. each Salt per 100 Gms. Solvent. Laurate.	Myristate.	Palmitate.	Stearate.
Water	35	...	0.007	0.004	0.004
"	50	...	0.007	0.006	0.004
Abs. Ethyl Alcohol	25	0.009	0.008	0.007	0.007
" "	50	0.009	0.008	0.007	0.007
Methyl Alcohol	15	0.074	0.063	0.060	0.051
" "	25	0.072	0.067	0.059	0.052
" "	35	0.078	0.071	0.062	0.055
" "	50	0.083	0.073	0.066	0.060
Ether	15	0.010	0.009	0.009	0.007

SILVER LEVULINATE (Acetyl propionate) $CH_3.COCH_2CH_2COOAg$.

SOLUBILITY IN WATER.

(Furcht and Lieben, 1909.)

t°.	Gms per 100 Gms Sat Solution	
8	0.5363 (white salt)	0.5195 (yellow salt)
9	0.5166	0.5372
14–15	0.6078 "	0.6448 "
99.6	3.49	3.70

SILVER MALATE $C_4H_4O_5Ag_2$.

100 gms. H_2O dissolve 0.0119 gms. at 18°, and 0.1216 gm. at 25°. (Partheil and Hübner, 1903.)

SILVER NITRATE $AgNO_3$.

SOLUBILITY IN WATER.

(Etard, 1894; Kremers, 1854, Tilden and Shenstone, 1884.)

t°.	Gms $AgNO_3$ per 100 Gms Solution		Water.	t°.	Gms $AgNO_3$ per 100 Gms. Solution		Water.
−5	48 (Etard)	...	...	50	79 (Etard)	82	455
0	53	55	122	60	81.5	84	525
10	62	63	170	80	85.5	87	669
20	68	69	222	100	88.5	90½	952
25	70.5	72	257	120	91	95	1900
30	72.5	75	300	140	93.5	...	...
40	76.5	79	376	160	95	...	...

100 gms. sat. aq. solution contain 47.1 gms. $AgNO_3$ at −7.3° (= Eutectic). (Middleberg, 1903)

100 gms. sat. aq. sol. contain 65.5 gms. $AgNO_3$ at 15.5°. (Greenish and Smith, 1903.)

100 gms. sat. aq. sol. contain 73 gms. $AgNO_3$ at 30°. (Schreinemakers and de Baat, 1910a.)

SOLUBILITY OF SILVER NITRATE IN AQUEOUS NITRIC ACID AT 25°.

(Masson, 1911)

d_{25} of Sat. Sol.	Gm. Mols. per Liter. HNO_3	$AgNO_3$	Gms $AgNO_3$ per Liter.	d_{25} of Sat. Sol.	Gm Mols. per Liter. HNO_3	$AgNO_3$	Gms. $AgNO_3$ per Liter.
2.3921	0	10.31	1752	1.4980	4.497	2.590	440.1
2.2754	0.4042	9.36	1591	1.4195	5.992	1.698	288.6
2.1243	0.962	8.08	1373	1.3818	8.84	0.843	143.2
1.9402	1.698	6.54	1111	1.3976	12.53	0.347	58.96
1.7052	2.834	4.526	769.1				

100 gms $2HNO_3.3H_2O$ dissolve 3.33 gms. $AgNO_3$ at 20°, and 16.6 gms. at 100°. (Schultz, 1860.)

100 gms. conc. HNO_3 dissolve 0.2 gm. $AgNO_3$.

Solubility of Mixed Crystals of Silver Nitrate and Sodium Nitrate in Aqueous Ethyl Alcohol.

(Hissink, 1900.)

Results at 25° in Aq. C_2H_5OH of d_{20} = 0.945 (37 wt. %).				Results at 50° in Aq. C_2H_5OH of d_{17} = 0.859 (75 wt. %).			
Gms. per 100 Gms. Sol.		Wt. per cent in Mix Crystals.		Gms. per 100 Gms. Sol.		Wt. per cent in Mix Crystals.	
$AgNO_3$.	$NaNO_3$.	$AgNO_3$.	$NaNO_3$	$AgNO_3$.	$NaNO_3$.	$AgNO_3$.	$NaNO_3$
47.32	0.0	100	0.0	29.78	0.0	100	0.0
44.01	8.78	99.1	0.9	27.9	2.5	99.5	0.5
36.78	20.42	42.9	57.1	26.4	4.2	99.3	0.7
29 97	23.2	33.6	66.4	23.0	6.3	42.9	57.1
24.56	24.82	27.6	72.4	18.3	7.1	31.0	69.0
8.02	26.41	9.9	90.1	9.5	8.3	17.5	82.5
0.0	26.77	0.0	100.0	0.0	8.54	0.0	100.0

Very extensive data for equilibrium in the system silver nitrate, succinic acid nitrile and water are given by Middelberg (1903). This author first gives data for the ternary systems and then results for isotherms of the ternary system at 0°, 12°, 20°, 25° and 26.5°. A number of determinations for higher temperatures are also given. The following compounds of succinic nitrile and silver nitrate were identified: $C_2H_4(CN)_2.4AgNO_3$, $C_2H_4(CN)_2.2AgNO_3$, $C_2H_4(CN)_2.AgNO_3$, $2C_2H_4(CN)_2.AgNO_3.H_2O$, and $4[2C_2H_4(CN)_2.AgNO_3]H_2O$. Additional data for this system are also given by Timmermans (1907).

Solubility of Silver Nitrate in Alcohols.

(de Bruyn, 1892.)

100 gms. abs. methyl alcohol dissolve 3.72 gms. $AgNO_3$ at 19°.
100 gms. abs. ethyl alcohol dissolve 3.10 gms. $AgNO_3$ at 19°.

Solubility of Silver Nitrate in Aqueous Ethyl Alcohol.

(Eder, 1878.)

Sp. Gr of Aq. Alcoholic Mixture	Volume per cent Alcohol	Gms. $AgNO_3$ per 100 Gms Aq Alcohol at: 15°.	50°.	75°.
0.815	95	3.8	7.3	18.3
0 863	80	10.3	...	42.0
0.889	70	22.1	...	...
0.912	60	30.5	58.1	89.0
0.933	50	35.8	...	...
0.951	40	56.4	98.3	160.0
0.964	30	73.7	...	...
0 975	20	107.0	214.0	340.0
0.986	10	158 0	...	...

100 gms. of a mixture of 1 vol. (95%) alcohol + 1 vol. ether dissolve 1.6 gms. $AgNO_3$ at 15°.

100 gms. of a mixture of 2 vols. (95%) alcohol + 1 vol. ether dissolve 2.3 gms. $AgNO_3$ at 15°.

100 gms. H_2O sat. with ether dissolve 88.4 gms. $AgNO_3$ at 15°. (Eder, 1878.)

100 gms. acetone dissolve 0.35 gm. $AgNO_3$ at 14°, and 0.44 gm. at 18°.

(von Lasczynski, 1894; Naumann, 1904.)

SOLUBILITY OF SILVER NITRATE IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. per 100 Gms. Solvent.	Authority.
Acetonitrile (anhydrous)	18	290	(Naumann and Schier, 1914.)
"	ord. temp.	about 150	(Scholl and Steinkopf, 1906.)
Benzonitrile	18	about 105	(Naumann, 1914.)
Benzene	35	0.022	(Linebarger, 1895.)
"	40.5	0.044	
Hydrazine (anhydrous)	ord. temp.	1 (with decomp.)	(Welsh and Broderson, 1915.)

SOLUBILITY OF SILVER NITRATE IN PYRIDINE.
(Kahlenberg and Brewer, 1908.)

t°.	Gms. $AgNO_3$ per 100 Gms. C_5H_5N.	Solid Phase.	t°.	Gms. $AgNO_3$ per 100 Gms. C_5H_5N.	Solid Phase.
−48.5 m. pt.	0	C_5H_5N	45	62.26	$AgNO_3.3C_5H_5N$
−50.5	3	"	46	63.09	"
−53	6	"	47	66.35	"
−59	9	"	48	70.85	"
−65 Eutec.	...	"+$AgNO_3$.6C_5H_5N	48.5 tr. pt.	...	"+$AgNO_3$.2C_5H_5N
−51.25	11.1	$AgNO_3.6C_5H_5N$	45	69.85	$AgNO_3.2C_5H_5N$
−44	11.7	"	50	72.25	"
−40	12.2	"	60	78.60	"
−35	12.6	"	70	89.10	"
−30	13.9	"	80	121.21	"
−25	17.6	"	87	215.02	"
−24 tr. pt.	...	"+$AgNO_3$.3C_5H_5N	80	228.5	"
−22	18.8	$AgNO_3.3C_5H_5N$	74	230.6	"
−10	20.03	"	74	225.4	"
0	22.34	"	80	230.4	"
+10	27.21	"	87	237.1	"
20	33.64	"	90	241.9	"
30	40.86	"	100	253.8	"
40	53.52	"	110	271.4	"

Fusion-point data for mixtures of $AgNO_3 + TlNO_3$ are given by van Eyk (1905).

SILVER NITRITE $AgNO_2$.

SOLUBILITY IN WATER.
(Creighton and Ward, 1915.)

t°.	Gms. $AgNO_2$ per Liter.	t°.	Gms. $AgNO_2$ per Liter.	t°.	Gms. $AgNO_2$ per Liter.
0	1.55	20	3.40	40	7.15
10	2.20	25	4.14	50	9.95
15	2.75	30	5	60	13.63

The determinations by Abegg and Pick (1906) are slightly higher than the above at temperatures below 20°. Single determinations agreeing well with the above are given by Ley and Schaefer (1906), and by von Niementowski and von Roszkowski (1897).

SOLUBILITY IN AQUEOUS SOLUTIONS OF SILVER NITRATE AT 18°.
(Naumann and Rucker, 1905.)

Mols. per Liter.		Grams per Liter.		Mols. per Liter.		Grams per Liter.	
$AgNO_3$.	$AgNO_2$.	$AgNO_3$.	$AgNO_2$.	$AgNO_3$.	$AgNO_2$.	$AgNO_3$.	$AgNO_2$.
0.0000	0.02067	0.000	3.184	0.02067	0.01435	3.512	2.201
0.00258	0.01975	0.439	3.042	0.04134	0.01168	7.024	1.799
0.00517	0.01900	0.878	2.926	0.08268	0.00961	14.048	1.480
0.01033	0.01689	1.756	2.601				

SOLUBILITY OF SILVER NITRITE IN AQUEOUS SOLUTIONS OF SILVER NITRATE AND OF POTASSIUM NITRITE AT 25°.

(Creighton and Ward, 1915.)

In Aqueous $AgNO_3$. Mols. $AgNO_3$ per Liter.	Dissolved $AgNO_2$ per Liter. Mols.	= Gms.	In Aqueous KNO_2. Mols. KNO_2 per Liter.	Dissolved $AgNO_2$ per Liter. Mols.	Gms.
0	0.0269	4.135	0	0.0269	4.135
0.00258	0.0260	3.991	0.00258	0.0259	3.974
0.00588	0.0244	3.735	0.00588	0.0249	3.820
0.01177	0.0224	3.432	0.01177	0.0232	3.560
0.02355	0.0192	2.943	0.02355	0.0203	3.119
0.04710	0.0164	2.498	0.04710	0.0181	2.765

Additional determinations of the solubility of silver nitrite in aqueous silver nitrate solutions at 25° are given by Abegg and Pick (1905).

One liter aqueous 0.02 *n* $NaNO_2$ dissolves 3.185 gms. $AgNO_2$ at 25°.
" " " 0.20 *n* " " 3.016 " " "
" " " 0.20 *n* $NaNO_3$ " 4.956 " " "

(Ley and Schaefer, 1906; see also p. 660.)

100 gms. H_2O sat. with both salts contain 10.9 gms. $AgNO_2$ + 78.3 gms. $Sr(NO_2)_2$ at 14°. (Oswald, 1912, 1914.)

100 gms. acetonitrile dissolve about 23 gms. $AgNO_2$ at ord. temp. and about 40 gms. at the boiling-point (81.6°). (Scholl and Steinkopf, 1906.)

SILVER OXALATE $Ag_2C_2O_4$.

One liter H_2O dissolves 0.0378 gm. $Ag_2C_2O_4$ at 21°, see Note, p. 608. (Whitby, 1910.)

One liter H_2O dissolves 0.0416 gm. $Ag_2C_2O_4$ at 25°. Conductivity method. (Schäfer, 1905.)

One liter H_2O dissolves 0.0265 gm. $Ag_2C_2O_4$ at 9.72°, 0.034 gm. at 18.5° and 0.043 gm. at 26.9°. (Kohlrausch, 1908.)

SOLUBILITY OF SILVER OXALATE IN AQUEOUS NITRIC ACID AT 25°.

(Hill and Simmons, 1909.)

Normality of Aq. HNO_3.	Per cent Conc of HNO_3.	d_{25} of Sat Sol.	Gms. $Ag_2C_2O_4$ per Liter.	Normality of Aq. HNO_3.	Per cent Conc. of HNO_3.	d_{25} of Sat. Sol.	Gms. $Ag_2C_2O_4$ per Liter.
0.2517	1.574	1.0080	1.345	4.017	22.37	1.1415	17.11
0.5025	3.117	1.0186	2.189	5.564	29.84	1.1996	29.96
0.9806	6.017	1.0339	3.720	5.83	31.085	1.2162	33.88
1.040	11.476	1.0647	7.170				

SILVER OXIDE Ag_2O.

One liter of H_2O dissolves 0.021 gm. at 20°, and 0.025 gm. at 25°. (Noyes and Kohr; Böttger; Abegg and Cox.)

One liter H_2O dissolves 0.0215 gm. Ag_2O at 20°. (See Note, p. 608.) (Whitby, 1910.)

SOLUBILITY OF SILVER OXIDE IN WATER.

(Rebiere, 1915.)

Method of Preparation of the Sample.	Gm Mols. Ag_2O per Liter. At 25°.	At 50°.	Gms. Ag_2O per Liter. At 25°.	At 50°.
By action of NaOH on $AgNO_3$	$2.16 \cdot 10^{-4}$	$2.97 \cdot 10^{-4}$	0.050	0.0691
By action of $Ba(OH)_2$ on $AgNO_3$	$2.23 \cdot 10^{-4}$	$3.09 \cdot 10^{-4}$	0.0519	0.0719
By action of KOH on AgCl	$2.32 \cdot 10^{-4}$	$3.55 \cdot 10^{-4}$	0.0538	0.0825
By action of KOH on Ag_2CO_3	$2.95 \cdot 10^{-4}$	$3.89 \cdot 10^{-4}$	0.0680	0.0904

SOLUBILITY OF SILVER OXIDE IN AQUEOUS AMMONIA AT 25°.

(Whitney and Melcher, 1903.)

Mols. NH_3 (Total) per Liter.	Gm. Atoms Ag per Liter.	Mols. NH_3 (Total) per Liter.	Gm. Atoms Ag per Liter.	Mols. NH_3 (Total) per Liter.	Gm. Atoms Ag per Liter.
0.220	0.0658	0.733	0.224	1.147	0.343
0.469	0.134	0.876	0.257	1.498	0.454
0.684	0.205	0.915	0.276	1.522	0.470

SOLUBILITY OF SILVER OXIDE IN AQUEOUS SOLUTIONS OF ETHYL AMINE AND OF METHYL AMINE AT 18°.

(Euler, 1903.)

In Aqueous Ethyl Amine.		In Aqueous Methyl Amine.	
Normality of Aq. Amine.	Normality of Dissolved Ag.	Normality of Aq. Amine.	Normality of Dissolved Ag.
0.100	0.0322	0.100	0.0221
0.50	0.160	0.500	0.118
1	0.314	1	0.228

SILVER PERMANGANATE $AgMnO_4$.

100 gms. cold water dissolve 0.92 gm.: hot water dissolves more.
(Mitscherlich, 1832.)

SILVER PHOSPHATE Ag_3PO_4.

One liter of water dissolves 0.00644 gm. at 20°. (Böttger, 1903.)

SILVER PROPIONATE C_2H_5COOAg.

SOLUBILITY IN WATER.

(Raupenstrauch, 1885; Arrhenius, 1893; Goldschmidt, 1898.)

t°.	Gms. $C_3H_5O_2Ag$ per Liter.	t°.	Gms. $C_3H_5O_2Ag$ per Liter.	t°.	Gms. $C_3H_5O_2Ag$ per Liter.
0	5.12	20	8.36 (8.48)	50	13.35
10	6.78	25	9.06	70	17.64
18.2	8.36 (A)	30	9.93 (9.70)	80	20.30

SOLUBILITY OF SILVER PROPIONATE IN AQUEOUS SOLUTIONS OF:

(Arrhenius.)

Silver Nitrate at 19.7°.				Sodium Propionate at 18.2°.			
Mols. per Liter.		Gms per Liter.		Mols per Liter.		Gms. per Liter.	
$AgNO_3$.	$C_3H_5O_2Ag$.	$AgNO_3$.	$C_3H_5O_2Ag$.	$C_3H_5O_2Na$.	$C_3H_5O_2Ag$.	$C_3H_5O_2Na$.	$C_3H_5O_2Ag$.
0	0.0471	0	8.519	0	0.0462	0	8.362
0.0133	0.0415	2.289	7.511	0.0167	0.0393	1.607	7.114
0.0267	0.0379	4.577	6.86	0.0333	0.0345	3.215	6.244
0.0533	0.0307	9.059	5.556	0.0667	0.0258	6.429	4.670
0.100	0.0222	16.997	4.019	0.1333	0.0191	12.859	3.456
				0.2667	0.0131	25.718	2.371
				0.5000	0.0101	48.77	1.828

SILVER SALICYLATE $C_6H_4.OH.COOAg$ 1,2.

One liter of aqueous solution contains 0.95 gm. at 23°. (Holleman, 1893.)

SILVER SUCCINATE $C_4H_4O_4Ag_2$.

100 gms. H_2O dissolve 0.0176 gm. at 18°, and 0.0199 gm. at 25°.
(Partheil and Hübner, 1903.)

SILVER SULFATE Ag_2SO_4.

SOLUBILITY IN WATER.

(Barre, 1911.)

t°.	Gms. Ag_2SO_4 per 100 Gms. Sat. Sol.	t°.	Gms. Ag_2SO_4 per 100 Gms. Sat. Sol.	t°.	Gms. Ag_2SO_4 per 100 Gms. Sat. Sol.
0	0.57	30	0.88	70	1.21
10	0.69	40	0.97	80	1.28
20	0.79	50	1.05	90	1.34
25	0.834	60	1.14	100	1.39

The result at 25° is the average of the very accurate and closely agreeing determinations of Hill and Simmons (1909), Rothmund (1910) and Harkins (1911). Earlier determinations, differing somewhat from the above, are given by Euler (1904), Wright and Thompson (1884), Wentzel ( ) and Drucker (1901).

Solubility of Silver Sulfate in Aqueous Solutions of Ammonium Sulfate.

(Barre, 1911.)

Results at 33°. Gms. per 100 Gms. Sat. Sol. $(NH_4)_2SO_4$.	Ag_2SO_4.	Results at 51°. Gms. per 100 Gms. Sat. Sol. $(NH_4)_2SO_4$.	Ag_2SO_4.	Results at 75°. Gms. per 100 Gms. Sat. Sol. $(NH_4)_2SO_4$.	Ag_2SO_4.	Results at 100°. Gms. per 100 Gms. Sat. Sol. $(NH_4)_2SO_4$.	Ag_2SO_4.
8.85	1.101	8.90	1.362	8.80	1.758	9.23	2.221
15.90	1.331	16.27	1.680	15.23	2.155	15	2.626
22.22	1.500	22.43	1.887	22.30	2.490	22.01	3.075
27.25	1.585	32.10	2.061	28.25	2.734	27	3.325
30.80	1.619	35.38	2.095	32	2.823	34.90	3.663
35.88	1.627	39.03	2.082	35.82	2.889	38.70	3.772
39.46	1.600	42.37	2.055	41.16	2.929	44.15	3.854
43.22	1.557	45.05	2.026	46.46	2.902	47.63	3.867

A series of determinations at 16.5° is also given.

Solubility of Silver Sulfate in Aqueous Nitric Acid at 25°.

(Hill and Simmons, 1909.)

Normality of Aq. HNO_3.	Per cent Conc. of Aq. HNO_3.	d_{25} of Sat. Sol.	Gms. Ag_2SO_4 per Liter.	Normality of Aq. HNO_3.	Per cent Conc. of Aq. HNO_3.	d_{25} of Sat. Sol.	Gms. Ag_2SO_4 per Liter.
0	0	1.0054	8.35	4.209	23.33	1.1956	73.212
1.0046	6.154	1.061	34.086	5.564	29.84	1.2456	84.609
2.0452	12.005	1.1069	49.010	8.487	42.37	1.3326	94.671
4.017	22.37	1.1871	71.166	10.034	48.77	1.3676	90.806

Solubility of Silver Sulfate in Aqueous Solutions of Acids and Salts at 25°.

(Swan, 1899.)

Acid or Salt	Gm. Equiv. per Liter.	Gms. Dissolved Ag_2SO_4 per Liter.	Acid or Salt.	Gm. Equiv. per Liter.	Gms. Dissolved Ag_2SO_4 per Liter.
HNO_3	0	8.41	H_2SO_4	0	8.41
"	0.01589	9.33	"	0.02902	8.55
"	0.03178	10.18	"	0.05802	8.68
"	0.06357	11.83	"	0.10526	8.86
$KHSO_4$	0.05264	8.13	K_2SO_4	0.02718	7.93
"	0.10526	8.07	"	0.05434	7.68

Solubility of Silver Sulfate in Aqueous Solutions of Salts at 25°.

(Harkins, 1911.)

Salt.	Gm. Equiv. Salt per Liter.	d_{25} Sat. Sol.	Gms. Ag_2SO_4 per Liter.	Salt.	Gm. Equiv. Salt per Liter.	d_{25} of Sat. Sol.	Gms. Ag_2SO_4 per Liter.
KNO_3	0	...	8.344	$AgNO_3$	0.09961	1.0137	2.644
"	0.024914	1.0072	8.996	K_2SO_4	0.025024	1.0064	7.899
"	0.049774	1.0092	9.531	"	0.050044	1.0079	7.694
"	0.09987	1.0034	10.435	"	0.100	1.0112	7.49
$Mg(NO_3)_2$	0.024764	1.0073	9.267	"	0.20003	1.0180	7.531
"	0.049595	1.0094	10.029	$MgSO_4$	0.020022	1.0061	8.140
"	0.09946	1.0133	11.334	"	0.050069	1.0079	7.941
$AgNO_3$	0.024961	1.0065	6.095	"	0.10004	1.0105	7.740
"	0.04986	1.0084	4.487	"	0.20005	1.0164	7.733

One liter of aqueous solution in contact with a mixture of silver sulfate and silver acetate contains 3.95 gms. Ag_2SO_4 + 8.30 gms. CH_3COOAg at 17°. Sp. Gr. of solution = 1.0094. (Euler, 1904.)

SOLUBILITY OF SILVER SULFATE AT 25° IN AQUEOUS SOLUTIONS OF:
(Drucker, 1901.)

Sulfuric Acid.				Potassium Sulfate.			
Mols. per Liter.		Gms. per Liter.		Mols. per Liter.		Gms. per Liter.	
Ag_2SO_4.	H_2SO_4.	Ag_2SO_4.	H_2SO_4.	Ag_2SO_4.	K_2SO_4.	Ag_2SO_4.	K_2SO_4.
0.0260	0.02	8.11	0.98	0.0246	0.02	7.67	1.74
0.0264	0.04	8.23	1.96	0.0236	0.04	7.36	3.49
0.0271	0.10	8.45	4.90	0.0231	0.10	7.20	8.72
0.0275	0.20	8.58	9.81	0.0232	0.20	7.24	17.44

SOLUBILITY OF SILVER SULFATE IN AQUEOUS POTASSIUM SULFATE SOLUTIONS.
(Barre, 1911.)

Results at 33°.		Results at 51°.		Results at 75°.		Results at 100°.	
Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.		Gms. per 100 Gms. Sat. Sol.	
K_2SO_4.	Ag_2SO_4.	K_2SO_4.	Ag_2SO_4.	K_2SO_4.	Ag_2SO_4.	K_2SO_4.	Ag_2SO_4.
3.22	0.863	3.20	1.023	3.12	1.273	3.23	1.488
5.62	0.940	5.61	1.127	5.73	1.406	5.60	1.675
8.37	1.046	8.40	1.247	8.43	1.554	8.45	1.890
10.41	1.117	10.55	1.340	10.55	1.665	11.30	2.115
11.80	1.177	13.16	1.450	13.17	1.806	15.07	2.410
		14.37	1.524	17.06	2.021	18.58	2.677

Results at 14.5° are also given.

SOLUBILITY OF SILVER SULFATE IN AQUEOUS SODIUM SULFATE SOLUTIONS.
(Barre, 1910, 1911.)

Results at 33°.		Results at 51°.		Results at 75°.		Results at 100°.	
Gms. per 100 Gms. Sat Sol.		Gms per 100 Gms. Sat Sol		Gms. per 100 Gms. Sat Sol.		Gms per 100 Gms. Sat Sol.	
Na_2SO_4.	Ag_2SO_4	Na_2SO_4.	Ag_2SO_4.	Na_2SO_4.	Ag_2SO_4.	Na_2SO_4.	Ag_2SO_4.
0.25	0.861	0.25	1.032	0.20	1.215	0.50	1.341
0.98	0.816	1.02	0.995	0.98	1.210	1.01	1.363
2.01	0 832	1.90	1.017	1.96	1.238	1.94	1.418
3	0.867	2.92	1.053	2.98	1.296	3.02	1.494
5.34	0.972	5.40	1.173	5.37	1.458	5.33	1.651
10.05	1.150	10.11	1.379	9.81	1.697	10.15	2.012
20.09	1.448	20.25	1.705	19.98	2.075	25 45	2.351
29.55	1.570	29.23	1.802	29.66	2.138	34.72	2.012
39.44	1.462	39 30	1.540	38.94	1.603	38.63	1.687
46.976	0.932	44.46	0 882	41.36	1.156	40.16	1.158

Results at 14.5° and at 18° are also given.

SOLUBILITY IN SILVER SULFATE IN AQUEOUS 0.5 *n* SOLUTIONS OF VARIOUS COMPOUNDS AT 25°.
(Rothmund, 1910)

Aq. 0.5 *n* Solution of:	Gms. Dissolved Ag_2SO_4 per Liter.	Aq. 0 5 *n* Solution of:	Gms. Dissolved Ag_2SO_4 per Liter.	Aq 0.5 *n* Solution of:	Gms. Dissolved Ag_2SO_4 per Liter.
Methyl Alcohol	7.764	Glycerol	8.202	Acetonitrile	16.37
Ethyl Alcohol	7.109	Mannitol	9.262	Glycocol	13.50
Propyl Alcohol	6.798	Grape Sugar	8.418	Acetic Acid	7.857
Amyl Alc. (tert.)	6.36	Urea	9.448	Phenol	11.81
Acetone	6.86	Dimethylpyrone	6.736	Chloral	7.266
Ether	6.424	Urethan	7.078	Methylal	6.393
Formaldehyde	7.078	Formamide	8.42	Methyl Acetate	6.6[illegible]
Glycol	8.076	Acetamide	7.794		

Fusion-point data for $Ag_2SO_4 + Na_2SO_4$ are given by Nacken (1907).

SILVER SULFIDE Ag_2S.

One liter H_2O dissolves about 4.10^{-11} gm. atoms Ag as sulfide at about 18°. (Bernfeld, 1898.)

One liter H_2O dissolves $0.55.10^{-6}$ gm. mols. = 0.0001363 gm. Ag_2S at 18°. (Weigel, 1907.)

Fusion-point data for $Ag_2S + ZnS$ are given by Friedrich (1908).

SILVER SULFONATES

SOLUBILITY IN WATER AT 20°.
(Sandquist, 1912.)

Sulfonate.	Gms. Sulfonate per 100 Gms. H_2O.
Silver .2 Phenanthrene Monosulfonate]	0.099
" .3 " "	0.20
" .10 " "	0.52

SILVER TARTRATE $C_4H_4O_6Ag_2$.

100 gms. H_2O dissolve 0.2012 gm. $C_4H_4O_6Ag_2$ at 18°, and 0.2031 gm. at 25°. (Partheil and Hübner, 1903.)

SILVER THIOCYANATE AgSCN.

SOLUBILITY IN WATER.

t°.	Gm. AgSCN per Liter.	Authority.
20	0.00014	(Böttger, 1903.)
21	0.00025	(Whitby, 1910. See Note, p. 608.)
25	0.00017	(Küster and Thiel, 1903.)
25	0.0002	(Abegg and Cox, 1903.)
100	0.0064	(Bottger, 1906.)

Additional data for the solubility of AgSCN in water are given by Kirschner (1912.)

SOLUBILITY OF SILVER THIOCYANATE IN AQUEOUS POTASSIUM THIOCYANATE AT 25°. (Hellwig, 1900.)

Mols. KSCN per Liter.	Mols. AgSCN per Liter.	Gms. AgSCN per Liter.	Mols KSCN per Liter.	Mols. AgSCN per Liter.	Gms. AgSCN per Liter.
0.573	0.0124	2.06	1.12	0.0975	16.18
0.626	0.0168	2.08	1.20	0.120	19.93
1.066	0.0850	14.01	1.25	0.134	22.34

One liter of aqueous 3 *n* $AgNO_3$ dissolves 0.0432 gm. AgSCN at 25.2°. (Hellwig, 1900.)

SILVER VALERATES $AgC_5H_9O_2$.

Normal Valerate, $CH_3(CH_2)_3.COOAg$. Iso Valerate, $CH_3.CH(CH_3)_2CH_2COOAg$.

SOLUBILITY OF EACH SEPARATELY IN WATER.
(Fürth, 1888; Sedlitzky, 1887.)

t°.	Gms. per 100 Gms. H_2O. Normal V.	Iso V.	t°.	Gms. per 100 Gms. H_2O. Normal V.	Iso V.
0	0.229	0.177	50	0.474	0.360
10	0.259	0.211	60	0.552	0.401
20	0.300	0.246	70	0.636	0.443
30	0.349	0.283	80	...	0.486
40	0.408	0.321			

100 gms. H_2O dissolve 0.73 gm. silver valerate at 20°. (Markwald, 1899.)

100 cc. sat. aq. solution contains 0.71 gm. dextro silver valerate at 15°. (Taverne, 1900.)

SOLUBILITY OF SILVER VALERATE IN AQUEOUS SOLUTIONS OF SILVER ACETATE, SILVER NITRATE AND OF SODIUM VALERATE.
(Arrhenius, 1893.)

In Silver Acetate at 17.8°.

Mols. per Liter. $C_2H_3O_2Ag$.	Mols. per Liter. $C_5H_9O_2Ag$.	Gms. per Liter. $C_2H_3O_2Ag$.	Gms. per Liter. $C_5H_9O_2Ag$.
0	0.0094	0	1.96
0.0067	0.0070	1.13	1.46
0.0135	0.0057	2.27	1.19
0.0270	0.0037	4.54	0.77
0.0505	0.00265	8.48	0.55

In Silver Nitrate at 16.5°.

Mols. per Liter. $AgNO_3$.	Mols. per Liter. $C_5H_9O_2Ag$.	Gms. per Liter. $AgNO_3$.	Gms. per Liter. $C_5H_9O_2Ag$.
0	0.0094	0	1.96
0.0067	0.0068	1.14	1.42
0.0133	0.0051	2.29	1.07
0.0267	0.0031	4.58	0.65
0.1000	0.0012	17.	0.25

In Sodium Valerate at 18.6°.

Mols. per Liter. $C_5H_9O_2Na$.	Mols. per Liter. $C_5H_9O_2Ag$.	Gms. per Liter. $C_5H_9O_2Na$.	Gms. per Liter. $C_5H_9O_2Ag$.
0	0.0095	0	1.986
0.0175	0.0047	2.17	0.982
0.0349	0.0030	4.32	0.627
0.0698	0.0018	8.65	0.376
0.1395	0.0015	17.31	0.313

SILVER VANADATE $Ag_6V_4O_{13}$.

One liter of aqueous solution contains 0.047 gm. at 14°, and 0.073 gm. at 100°. (Carnelly, 1873.)

SODIUM Na.

SOLUBILITY IN LIQUID AMMONIA.
(Ruff and Geisel, 1906.)

t°.	Mols. NH_3 Required to Dissolve 1 Gm. Atom Na.	t°.	Mols. NH_3 Required to Dissolve 1 Gm. Atom Na.
−105	4.98	−30	5.52
− 70	5.20	0	5.87
− 50	5 39	+22	6.14

SOLUBILITY OF SODIUM IN MELTED SODIUM HYDROXIDE.
(von Hevesy, 1909.)

t°.	480°	600°	610°	670°	760°	800°
Gms. Na per 100 Gms. NaOH	25.3	10.1	9.9	9.5	7.9	6.9

Saturation could not be reached at temperatures below 480°. The saturated mixtures were cooled by plunging the container in water and the solidified contents analyzed.

SOLUBILITY OF SODIUM IN MELTED SODIUM HYDROXIDE CONTAINING OTHER METALS AT 480°.
(von Hevesy, 1909.)

Added Metal.	Gms. Added Metal per 100 Gms. NaOH.	Gms. Dissolved Na per 100 Gms. Solvent.	Added Metal.	Gms. Added Metal per 100 Gms. NaOH.	Gms. Dissolved Na per 100 Gms. Solvent.
Thallium	5.40	23.13	Cadmium	2.87	24.34
"	8.30	23.54	"	3.16	24.29
"	12.42	21.29	Gold	6.03	23.92
"	31.37	20.91	"	8.22	23.39
			Zinc	30.37	25.38

SODAMMONIUM $Na_2(NH_3)_2$.

100 gms. liquid ammonia dissolve 60.5 gms. $Na_2(NH_3)_2$ at −23°, 56.4 gms. at 0°, 56 gms. at +5° and 55 gms. at 9°. (Joannis, 1906.)

SODIUM ACETATE $CH_3COONa.3H_2O$.

SOLUBILITY IN WATER.

(Green, 1908.)

t°.	Gms. CH_3COONa per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. CH_3COONa per 100 Gms. H_2O.	Solid Phase.
−10	19	Ice	20	123.5	CH_3COONa (unstable)
−18	30.4	"	30	126	" "
−10	33	$CH_3COONa.3H_2O$	40	129.5	" "
0	36.3	"	50	134	"
+10	40.8	"	60	139.5	"
20	46.5	"	70	146	"
30	54.5	"	80	153	"
40	65.5	"	90	161	"
50	83	"	100	170	"
58	138	"	110	180	"
0	119	CH_3COONa (unstable)	120	191	"
10	121	" "	123 b. pt.	193	"

Results differing somewhat from the above are given by Köhler (1897); Enklaar (1901) and Schiavor (1902).

SOLUBILITY OF SODIUM ACETATE IN AQUEOUS SOLUTIONS OF ACETIC ACID AT VARIOUS TEMPERATURES.

(Dunningham, 1912)

Results at 0°. Gms. per 100 Gms. Sat Solution.		Results at 15°. Gms per 100 Gms. Sat Solution		Results at 30°. Gms. per 100 Gms. Sat Solution.		Results at 75°. Gms. per 100 Gms. Sat. Solution		Solid Phase in Each Case.
Na_2O.	$(CH_3CO)_2O$.	Na_2O.	$(CH_3CO)_2O$.	Na_2O.	$(CH_3CO)_2O$.	Na_2O.	$(CH_3CO)_2O$.	
...	...	29.34	0.15	35.31	0.77	44.45	0.76	CH_3COONa
...	...	...	...	26.25	8.92	32.47	5.03	"
...	...	...	...	...	...	22.30	36.69	"
24.12	2.04	25.94	4.19	25.98	9.06	...	...	$CH_3COONa.3H_2O$
14.46	8.55	15.49	12.01	18.09	13.62	...	...	"
9.72	31	11.45	23.54	13.53	21.88	...	...	"
9.77	41.23	11.25	34.56	13.24	33.05	...	...	" +1.1
9.04	43.94	10.33	39.08	13.14	32.90	17.85	43.06	1.1
...	...	10.22	39.73	7.64	65.07	11.05	65.71	"
...	...	9.16	49.32	...	...	7.63	81.49	"
...	...	...	...	...	...	0.44	98.35	"
8.96	44.80	8.56	54.34	7.67	66.42	...	...	" +1.2
8.72	45.10	7.06	61.63	7.33	69.68	...	...	1.2
7.83	50.03	5.95	70.55	6.61	72.85	...	...	"
6.19	62.44	4.84	77.60	5.52	77.76	...	...	"
4.02	79.29	2.87	86.61	3.78	83.92	...	...	"
1.05	92.29	1.02	95.87	2.94	86.73	...	...	"
0.42	97.51	0.79	98.09	1.27	94.78	...	...	"

1.1 = $CH_3COONa.CH_3COOH$. 1.2 = $CH_3COONa.2CH_3COOH$.

Additional data for 5°, 20°, 45° and 60° are also given.

Similar data for 30° are given by Dukelski (1909), and for 20° by Abe (1911–12). One determination at 25°, expressed in terms of volume of solution, is given by Herz (1911–12). Two determinations at 10° similarly expressed, are given by Enklaar (1901).

Data for the freezing-point of mixtures of sodium acetate and acetic acid are given by Vasilev (1909).

Solubility of Sodium Acetate in Aqueous Ethyl Alcohol at 25°.

(Seidell, 1910.)

Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $CH_3COONa.3H_2O$ per 100 Gms. Sat. Sol.	Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $CH_3COONa.3H_2O$ per 100 Gms. Sat. Sol.
0	1.209	55.7	60	0.990	30.4
10	1.160	53	70	0.942	22.8
20	1.135	49.8	80	0.882	13
30	1.108	46.5	90	0.838	6.7
40	1.072	42	95	0.828	6.1
50	1.038	37	100	0.823	7.3

The solid phase in contact with the solution was $CH_3COONa.3H_2O$ in all cases.

100 gms. absolute alcohol dissolve 7.49 gms. $CH_3COONa.3H_2O$ at room temp. (Bödtker, 1897.)

Solubility of Sodium Acetate in Aqueous Alcohol:

At 18°. (Gerardin, 1865.)

Wt. Per cent Alcohol.	Gms. CH_3COONa per 100 Gms. Aq. Alcohol.
5.2	38
9.8	35.9
23	29.8
29	27.5
38	23.5
45	20.4
59	14.6
86	3.9
91	2.1

At Different Temperatures. (Schiavor, 1902.)

t°.	Degree of Alcohol.	Gms. per 100 Gms. Alcohol. CH_3COONa.	$CH_3COONa.3H_2O$.
8	98.4	2.08	3.45
12	98.4	2.12	3.51
19	98.4	2.33	3.86
11	90	2.07	3.42
13	90	2.13	3.52
15	63	13.46	22.32
18	63	13.88	23.03
21	63	14.65	24.30
23	40	28.50	47.27

100 gms. H_2O dissolve 237.6 gms. sugar + 57.3 gms. CH_3COONa, or 100 gms. of the saturated solution contain 58.93 gms. sugar + 14.44 gms. CH_3COONa at 31.25°. (Köhler, 1897.)

100 cc. anhydrous hydrazine dissolve 5 gms. sodium acetate at room temp. (Welsh and Broderson, 1915.)

100 gms. propyl alcohol dissolve 0.97 gm. sodium acetate. (Schlamp, 1894.)

SODIUM SulfoANTIMONATE $Na_3SbS_4.9H_2O$.

Solubility in Water.

(Donk, 1908.)

t°.	Gms. Na_3SbS_4 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms Na_3SbS_4 per 100 Gms. Sat Sol	Solid Phase.	t°.	Gms. Na_3SbS_4 per 100 Gms Sat. Sol.	Solid Phase.
−0.1	0.5	Ice	−1.75	11.2	Ice	49.6	38.9	$Na_3SbS_4.9H_2O$
−0.65	4	"	0	11.8	$Na_3SbS_4.9H_2O$	59.6	45	"
−0.9	5.7	"	15	19.3	"	69.6	50.7	"
−1.26	7.8	"	30	27.1	"	79.5	57.1	"
−1.45	9.2	"	38	32	"			

Solubility of Sodium Sulfoantimonate in Aqueous Solutions of Sodium Hydroxide at 30°.

(Donk, 1908.)

Gms. per 100 Gms. Sat. Sol. Na_3SbS_4.	NaOH.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. Na_3SbS_4.	NaOH.	Solid Phase.
27.1	0	$Na_3SbS_4.9H_2O$	16.4	42.6	$Na_3SbS_4.9H_2O$
13	9.9	"	17.7	47.2	"+$NaOH.H_2O$
5.9	24.8	"	9.1	49.5	$NaOH.H_2O$
10.5	32.9	"	0	54.3	

SOLUBILITY OF SODIUM SULFOANTIMONATE IN AQUEOUS SOLUTIONS OF SODIUM THIOSULFATE.

(Donk, 1908.)

Results at 0°.

Gms. per 100 Gms. Sat. Sol. Na_3SbS_4.	Gms. per 100 Gms. Sat. Sol. $Na_2S_2O_3$.	Solid Phase.
11.8	0	$Na_3SbS_4.9H_2O$
4.4	4.9	"
0.8	14.6	"
0.1	27.3	"
0	33.6	" $+Na_2S_2O_3.5H_2O$
0	33.6	$Na_2S_2O_3.5H_2O$

Results at 30°.

Gms. per 100 Gms. Sat. Sol. Na_3SbS_4.	Gms. per 100 Gms. Sat. Sol. $Na_2S_2O_3$.	Solid Phase.
19.9	7.7	$Na_3SbS_4.9H_2O$
12.5	16.4	" "
4.2	37.7	"
1	43.8	"
1	47	"
1	47.8	" $+Na_2S_2O_3.5H_2O$
0	45.8	$Na_2S_2O_3.5H_2O$

SOLUBILITY OF SODIUM SULFOANTIMONATE IN AQUEOUS ETHYL ALCOHOL.

(Donk, 1908.)

Results at 0°. Gms. per 100 Gms Sat Sol. Na_3SbS_4.	C_2H_5OH.	Results at 30°. Gms. per 100 Gms Sat Sol. Na_3SbS_4.	C_2H_5OH.	Results at 65°. Gms. per 100 Gms Sat. Sol. Na_3SbS_4.	C_2H_5OH.
11.8	0	19.3	5	47.9	0
8.2	3.7	14.6	10.3	39.3	4.7
3.2	12.7	6.4	24.8	36.5	8*
0.9	29	1.2	46	4.1	54.1*
0	60.8	0	76.2	0	81

* Two liquid layers separate between these concentrations of alcohol. The composition of several of these conjoined layers is as follows:

Gms. per 100 Gms. Alcoholic Layer. Na_3SbS_4.	C_2H_5OH.	Gms per 100 Gms. Aqueous Layer. Na_3SbS_4.	C_2H_5OH.
4.1	54.1	36.5	8
10.2	40.4	27.8	14.3
14.1	33.5	24.1	18.8
...	0	18	27.2

The solid phase in contact with each of the above solutions is $Na_3SbS_4.9H_2O$.

SOLUBILITY OF SODIUM SULFOANTIMONATE IN AQUEOUS METHYL ALCOHOL.

(Donk, 1908.)

Results at 0°.

Gms. per 100 Gms. Sat Sol Na_3SbS_4.	CH_3OH.	Solid Phase.
8.6	3.4	$Na_3SbS_4.9H_2O$
2.8	15.5	"
2.1	23.1	"
0.3	50.3	"
0.1	57	"
0.05	81.7	"
0.2	92	"
2	95.9	"

Results at 30°.

Gms per 100 Gms Sat Sol. Na_3SbS_4.	CH_3OH.	Solid Phase.
27.1	0	$Na_3SbS_4.9H_2O$
12.8	18.1	"
5.8	33.1	"
0.1	65.7	"
0.1	84.2	"
1.2	91.2	"
3.9	94	"

SODIUM ARSENATE $Na_3AsO_4.12H_2O$.

100 gms. aqueous solution contain 21.1 gms. $Na_3AsO_4.12H_2O$ (= 10.4 gms. Na_3AsO_4) at 17°. Sp. Gr. of solution = 1.1186. (Schiff, 1860.)

100 gms. glycerol dissolve 50 gms. sodium arsenate at 15.5°. (Ossendowski, 1907.)

EQUILIBRIUM IN THE SYSTEM SODIUM OXIDE, ARSENIC TRIOXIDE, WATER AT 25°.

(Schreinemakers and de Baat, 1917.)

Gms. per 100 Gms. Sat. Sol. As_2O_3.	Na_2O.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. As_2O_3.	Na_2O.	Solid Phase.
2.019	0	As_2O_3	31.05	21.82	$Na_4As_2O_5.9H_2O$
14.45	2.45	"	±29	±22.7	" $+Na_{10}As_4O_{11}.26H_2O$
24.42	4.23	"	21.92	24.04	$Na_{10}As_4O_{11}.26H_2O$
37.73	6.46	"	17.50	25.64	"
58.54	9.60	"	14.26	29.16	"
±73	±12	" $+NaAsO_2$	14.63	30.24	"
63.01	12.73	$NaAsO_2$	19.32	32.04	" $+Na_4As_2O_5$
57.90	13.24	"	15.53	33.57	$Na_4As_2O_5$
48.05	14.27	"	10.49	36.21	"
36.32	18.74	"	6.59	39.39	" $+NaOH.H_2O$
±34	±21.1	" $+Na_4As_2O_5.9H_2O$	5.11	39.69	$NaOH.H_2O$
32.24	21.6	$Na_4As_2O_5.9H_2O$	0	41.2	"

SODIUM Hydrogen ARSENATE $Na_2HAsO_4.12H_2O$.

SOLUBILITY IN WATER.

(Average curve from results of Schiff, 1860; Tilden, 1884; Greenish and Smith, 1903.)

t°.	Gms. Na_2HAsO_4 per 100 Gms. H_2O.	t°.	Gms. Na_2HAsO_4 per 100 Gms. H_2O.	t°.	Gms. Na_2HAsO_4 per 100 Gms. H_2O.
0	7.3	20	26.5	40	47
10	15.5	25	33	60	65
15	20.5 ($d=1.1765$)	30	37	80	85

SODIUM Diethyl BARBITURATE $Na(C_8H_{11}O_3N_2)$.

SOLUBILITY IN WATER.

(Puckner and Hilpert, 1909.)

t°.	5°	15°	25°	91°
Gms. Salt per 100 Gms. Sat. Sol.	6.08	16.87	17.18	32.50

SODIUM BENZOATE C_6H_5COONa.

SOLUBILITY IN AQUEOUS ETHYL ALCOHOL AT 25°.

(Seidell, 1910.)

Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. C_6H_5COONa per 100 Gms. Sat. Sol.	Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. C_6H_5COONa per 100 Gms. Sat. Sol.
0	1.155	36	60	0.975	21.3
10	1.132	35.3	70	0.927	15.4
20	1.110	33.7	80	0.877	8.8
30	1.086	31.5	90	0.831	2.8
40	1.055	28.9	95	0.812	1.3
50	1.020	25.6	100	0.795	0.6

SODIUM (Tetra) BORATE $Na_2B_4O_7.10H_2O$ (Borax).

SOLUBILITY IN WATER.

(Horn and Van Wagener, 1903.)

t°.	Gms. $Na_2B_4O_7$ per 100 Gms. H_2O.	t°.	Gms. $Na_2B_4O_7$ per 100 Gms. H_2O.	t°.	Gms. $Na_2B_4O_7$ per 100 Gms. H_2O.	
0.5	1.3	50	10.5	60	19.4	20.3
10	1.6	54	13.3	62	22	20.7
21.5	2.8	55	14.2	65	22	21.9
30	3.9	56	15	70	24.4	
37.5	5.6	57	16	80	31.5	
45	8.1			90	41	
				100	52.5	

Tr. temp., $Na_2B_4O_7.10H_2O \rightarrow Na_2B_4O_7.5H_2O$, approximately 62°.

$d_{16.5°}$ of sat. sol. = 1.020. (Greenish and Smith, 1901.)

100 gms. H_2O dissolve 3.33 gms. $Na_2B_4O_7$ at 25°, determined by refractometer. (Osaka, 1903–08.)

SOLUBILITY OF SODIUM BORATES IN WATER AT 30°.

(Dukelski, 1906, complete references given.)

Gms. per 100 Gms. Solution. Na₂O.	B₂O₃.	Gms. per 100 Gms. Residue. Na₂O.	B₂O₃.	Solid Phase.
42.0	...	...	...	$NaOH.H_2O$
41.37	5.10	43.54	4.19	"
38.85	5.55	37.20	11.18	$Na_2O.B_2O_3.4H_2O$
34.44	3.73	33.52	10.80	"
29.39	2.51	29.63	10.11	"
26.13	2.75	27.85	15.21	"
23.00	3.82	24.91	11.60	"
16.61	13.69	21.29	20.64	"
21.58	4.63	24.52	19.04	$Na_2O.B_2O_3.4H_2O + Na_2O.B_2O_3.8H_2O$
20.58	4.69	21.61	16.59	$Na_2O.B_2O_3.8H_2O$
15.32	6.21	19.70	17.84	"
12.39	9.12	18.05	18.17	"
8.85	10.49	11.72	20.62	$Na_2O.2B_2O_3.10H_2O$
5.81	6.94	10.82	21.31	"
1.88	2.41	7.31	15.50	"
1.38	5.16	7.16	17.44	"
2.02	7.79	6.24	16.38	"
4.08	17.20	8.96	29.20	$Na_2O.2B_2O_3.10H_2O + Na_2O.5B_2O_3.10H_2O$
3.79	15.84	5.68	28.19	$Na_2O.5B_2O_3.10H_2O$
2.26	12.14	5.21	29.19	"
1.99	11.84	5.74	39.66	$Na_2O.2B_2O_3.10H_2O + B(OH)_3$
1.86	11.18	1.06	28.78	$B(OH)_3$
0.64	6.11	0.31	31.19	"
...	3.54	...	...	"

EQUILIBRIUM IN THE SYSTEM SODIUM OXIDE, BORIC OXIDE, WATER AT 60°.

(Sborgi and Mecacci, 1915, 1916)

Gms. per 100 Gms. Sat. Sol. Na₂O.	B₂O₃.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. Na₂O.	B₂O₃.	Solid Phase.
49.25	0	$NaOH.H_2O$	19.29	22.78	$Na_2O.B_2O_3.4H_2O$
48.44	0.81	"	20.30	25.50	"
49.28	1.53	" $+2Na_2O.B_2O_3.H_2O$	22.21	32.17	" $+Na_2O.2B_2O_3.5H_2O$
47.38	2.24	$2Na_2O.B_2O_3.H_2O$	19.43	27.09	$Na_2O.2B_2O_3.5H_2O$
44.74	3.78	"	16.13	23.05	"
42.94	5.67	" $+Na_2O.B_2O_3.H_2O$	13.51	19.10	"
40.14	5.41	$Na_2O.B_2O_3.H_2O$	11.58	16.62	"
38.70	5.56	"	6.95	11.50	"
35.76	6.29	"	5.65	14.89	"
34.93	6.80	"	6.84	20.40	"
31.88	9.85	" (unstable)	8.42	28.05	"
29.56	11.83	" "	11.29	41.47	" $+Na_2O.5B_2O_3.10H_2O$
28.07	14.65	" "	8.29	33.57	$Na_2O.5B_2O_3.10H_2O$
33.12	7.47	" $+Na_2O.B_2O_3.4H_2O$	6.29	28.77	"
28.64	6.51	$Na_2O.B_2O_3.4H_2O$	3.22	21.94	"
22.06	10.29	"	3.40	22.59	" $+H_3BO_3$
18.72	17.33	"	1.39	13.92	H_3BO_3
18.32	19.17	"	0	7.39	"

SOLUBILITY OF SODIUM BORATES IN SEVERAL SOLVENTS.

Borate.	Solvent.	t°.	Gms. Salt per 100 Gms. Solvent.	Authority.
Sodium borate	Alcohol ($d=0.941$)	15.5	2.48	(U. S. P. VIII.)
" "	Glycerol	15.5	60.3	(U. S. P. VIII.)
" "	"	80	100	(U. S. P. VIII.)
Sodium Biborate	Trichlorethylene	15	0.011	(Wester and Bruins, 1914.)

Fusion-point data for mixtures of $NaBO_2+NaPO_3$ and $NaBO_2+Na_2SiO_3$ are given by Van Klooster (1910-11). Results for $Na_2B_4O_7+Na_4P_2O_7$ are given by Le Chatelier (1894).

SODIUM BROMATE $NaBrO_3$.

SOLUBILITY IN WATER.
(Kremers, 1855-56a.)

t°.	0°	20°	40°	60°	80°	100°
Gms. $NaBrO_3$ per 100 Gms. H_2O	27.5	34.5	50.2	62.5	75.7	90.9

Sp. Gr. of saturated solution at 19.5° = 1.231. (Gerlach.)
100 cc. anhydrous hydrazine dissolve 1 gm. $NaBrO_3$ with decomposition.
(Welsh and Broderson, 1915.)

SODIUM BROMIDE $NaBr.2H_2O$.

SOLUBILITY IN WATER.

t°.	Gms. NaBr per 100 Gms Sat Sol.	Solid Phase.	t°.	Gms. NaBr per 100 Gms. Sat. Sol.	Solid Phase.
−10.1	20.8 (1)	Ice	50	53.7 (4)	$NaBr.2H_2O$
−28	40.3 (2)	" $+NaBr.5H_2O$	50.7	53.9 (5)	" +NaBr
−23.5	41.2 (3)	$NaBr.5H_2O+NaBr.2H_2O$	80	54.2 (4)	NaBr
−20	41.8 (4)	$NaBr.2H_2O$	100	54.8 (4)	"
−10	42.9 (4)	"	110	55.1 (4)	"
0	44.3 (4)	"	140	56.5 (6)	"
+16.4°	47 (8)*	"	180	59.5 (6)	"
20	47.5 (4)	"	210	60.9 (6)	"
30	49.4 (7)	"	230	62 (6)	"
40	51.4 (4)	"			

* ($d_{16} = 1.523$).

(1) Rudorff (1862); (2) Guthrie (1875); (3) Panfiloff (1893); (4) de Coppet (1883); (5) Richards and Churchill (1899); (6) Etard (1894), (7) Cocheret (1911); (8) Greenish (1900)

SOLUBILITY OF SODIUM BROMIDE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE AT 17°.
(Ditte, 1897.)

Gms. per 100 Gms. H_2O.		Gms. per 100 Gms. H_2O.		Gms. per 100 Gms. H_2O.	
NaOH.	NaBr.	NaOH.	NaBr.	NaOH.	NaBr.
0.0	91.38	17.17	63.06	28.43	48.00
3.26	79.86	19.12	62.51	36.61	38.41
9.24	68.85	22.35	59.60	46.96	29.37
13.43	64.90	24.74	55.03	54.52	24.76

SOLUBILITY OF SODIUM BROMIDE IN AQUEOUS ETHYL ALCOHOL AT 30°.
(Cocheret, 1911.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
C_2H_5OH.	NaBr.		C_2H_5OH.	NaBr.	
0	49.4	$NaBr.2H_2O$	65.51	16.08	$NaBr.2H_2O$
11.79	42.9	"	72.36	13.41	"
31.78	32.12	"	76.92	12.03	" +NaBr
43.22	26.79	"	87.35	7.44	NaBr
54.59	20.83	"	97.08	3.01	"

SOLUBILITY OF SODIUM BROMIDE IN ALCOHOLIC SOLUTIONS.

(Rohland, 1898–05; de Bruyn, 1892; Eder, 1876.)

Alcohol.	Concentration of Aq. Alcohol.	t°.	Gms. NaBr per 100 Gms. Alcohol.	
Methyl Alcohol	$d_{15}=0.799$	room temp.	21.7	(R.)
Ethyl "	$d_{15}=0.810$	"	7.14	"
Propyl "	$d_{15}=0.816$	"	2.01	"
Ethyl "	90% by vol.	?	4.0 (hydrated NaBr)	"
Methyl "	Absolute	19.5	17.35	(de Bruyn.)
Ethyl "	"	15	6.3 ($NaBr_2H_2O$)	(Eder.)
Ethyl Ether		15	0.08	"

A sat. solution of NaBr in CH_3OH contains 0.9 gm. NaBr per 100 gms. solution at the critical temperature. (Centnerszwer, 1910.)

100 cc. of ethyl alcohol of $d = 0.8327$ dissolve 7.37 gms. NaBr at 16.4°, d_{16} of sat. sol. = 0.889. (Greenish, 1900)

100 gms. propyl alcohol dissolve 2.05 gms. NaBr at ord. temp. (Schlamp, 1894.)

SOLUBILITY OF SODIUM BROMIDE IN MIXTURES OF ALCOHOLS AT 25°.

(Herz and Kuhn, 1908).

In $CH_3OH + C_2H_5OH$.			In $CH_3OH + C_3H_7OH$.			In $C_2H_5OH + C_3H_7OH$.		
Per cent CH_3OH in Mixture.	d_{25} of Sat. Sol.	Gms. NaBr per 100 cc Sat. Sol.	Per cent C_3H_7OH in Mixture.	d_{25} of Sat. Sol.	Gms. NaBr per 100 cc. Sat. Sol.	Per cent C_3H_7OH in Mixture.	d_{25} of Sat. Sol.	Gms. NaBr per 100 cc. Sat. Sol.
0	0.8189	2.93	0	0.9238	14.40	0	0.8189	2.93
4.37	0.8265	3.65	11.11	0.9048	12.43	8.1	0.8147	2.49
10.4	0.8273	4.04	23.8	0.8887	10.53	17.85	0.8145	2.47
41.02	0.8593	7.24	65.2	0.8390	4.42	56.6	0.8107	1.90
80.69	0.9079	12.51	91.8	0.8153	1.47	88.6	0.8116	1.11
84.77	0.9104	12.86	93.75	0.8144	1.26	91.2	0.8083	0.83
91.25	0.9235	14.32	100	0.8093	0.74	95.2	0.8090	0.82
100	0.9238	14.40				100	0.8093	0.74

SOLUBILITY OF SODIUM BROMIDE IN ACETAMIDE AT VARIOUS TEMPERATURES.

(Menschutkin, 1908)

t°.	Gms. per 100 Gms. Sat. Sol. NaBr $2CH_3CONH_2$	= NaBr.	Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol. NaBr $2CH_3CONH_2$	= NaBr.	Solid Phase.
82*	...	...	CH_3CONH_2	90	29.4	13.7	$NaBr.2CH_3CONH_2$
80	6	2.8	"	100	32.2	15	"
78	11.5	5.36	"	110	35.3	16.4	"
76	16.3	7.6	"	120	38.7	18	"
74	20.2	9.4	"	130	42.6	19.8	"
72	23	10.7	"	135†	45.3	21.1	" +NaBr
70‡	25	11.6	" + $NaBr.2CH_3CONH_2$	155	46.4	21.6	NaBr
80	27	12.6	$NaBr.2CH_3CONH_2$	175	47.5	22.1	"

* M. pt. † Tr. pt. ‡ Eutec.

100 gms. 95% formic acid dissolve 22.3 gms. NaBr at 18.5°. (Aschan, 1913.)

100 cc. anhydrous hydrazine dissolve 37 gms. NaBr at room temp. (Welsh and Broderson, 1915.)

FUSION-POINT DATA (Solubilities, see footnote, p. 1) ARE GIVEN FOR THE FOLLOWING MIXTURES.

NaBr + NaCl	(Amadori, 1912a; Ruff and Plato, 1903.)
NaBr + NaI	(Amadori, 1912a.)
NaBr + NaF.	(Ruff and Plato, 1903.)
NaBr + NaOH	(Scarpa, 1915.)
NaBr + $NaNO_2$.	(Meneghini, 1912.)
NaBr + Na_2SO_4	(Ruff and Plato, 1903.)

SODIUM CACODYLATE $(CH_3)_2AsO.ONa$.

100 gms. H_2O dissolve about 200 gms. of the salt at 15°–20°. (Squire and Caines, 1905.)
100 cc. 90% alcohol dissolve about 100 gms. of the salt at 15°–20°. " "

SODIUM CAMPHORATIS

SOLUBILITY IN AQUEOUS *d* CAMPHORIC ACID SOLUTIONS AT 13.5°–16°.
(Jungfleisch and Landrieu, 1914.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
$C_{10}H_{16}O_4$.	$C_{10}H_{14}O_4Na_2$.		$C_{10}H_{16}O_4$.	$C_{10}H_{14}O_4Na_2$.	
0.621	0	$C_{10}H_{16}O_4$	2.87	25.62	$C_{10}H_{15}O_4Na.2C_{10}H_{16}O_4.2H_2O$
2.03	4.19	"	2.89	27.41	"
2.87	8.32	"	2.74	30.69	"
3.03	10.05	"	2.63	32.75	"
2.97	7.80	" $+C_{10}H_{15}O_4Na.2C_{10}H_{16}O_4.2H_2O$	2.29	40.10	$C_{10}H_{15}O_4Na.H_2O$ (or $\frac{1}{2}H_2O$)
2.87	9.06	$C_{10}H_{15}O_4Na.2C_{10}H_{16}O_4.2H_2O$	2.17	40.54	"
2.94	10.46	"	1.06	47.04	"
2.68	14.99	"	0.88	49.60	$C_{10}H_{14}O_4Na_2.3H_2O$
2.64	17.53	"	0	50.2	"

$C_{10}H_{16}O_4$ = Camphoric acid. $C_{10}H_{15}O_4Na.2C_{10}H_{16}O_4.2H_2O$ = Monosodium *d* tricamphorate. $C_{10}H_{15}O_4Na.H_2O$ = Monosodium *d* camphorate. $C_{10}H_{14}O_4Na_2.3H_2O$ = Disodium *d* camphorate (neutral).

(The mixtures were kept in a cellar at a nearly constant temperature and shaken from time to time. Additional determinations at 17°–23° are also given.)

SODIUM CARBONATE $Na_2CO_3.10H_2O$.

SOLUBILITY IN WATER.
(Wells and McAdam, Jr, 1907; Mulder, below 27° and above 44°.)

t°.	Gms. Na_2CO_3 per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. Na_2CO_3 per 100 Gms. H_2O.	Solid Phase.
0	7	$Na_2CO_3.10H_2O$	34.76	48.98	$Na_2CO_3.7H_2O$
5	9.5	"	35.62	50.08	"
10	12.5	"	35.50	...	" $+Na_2CO_3.H_2O$
15	16.4	"	29.86	50.53	$Na_2CO_3.H_2O$
20	21.5	"	31.80	50.31	"
27.84	34.20	"	35.17	49.63	"
29.33	37.40	"	36.45	49.36	"
30.35	40.12	"	37.91	49.11	"
31.45	43.25	"	41.94	48.51	"
32.06	45.64	"	43.94	47.98	"
32.15	...	" $+Na_2CO_3.7H_2O$	60	46.4	"
33.10	...	" $+Na_2CO_3.H_2O$	80	45.8	"
30.35	43.50	$Na_2CO_3.7H_2O$	100	45.5	"
32.86	46.28	"	105	45.2	"

The determinations of Wells and McAdam, Jr., were made with extreme care. They correct the discrepancies which have so far existed between the solubility and transition points of the hydrates. Earlier data, which differ more or less from the above, are given by Löwel, 1851; Reich, 1891; Eppel, 1899 and Ketner, 1901–02. Single determinations at 15°, 25°, and 30° are given by Greenish and Smith (1901); Osaka (1910–1911); de Paepe (1911) and Cocheret (1911).

Sp. Gr. of solution saturated at 17.5°, 1.165 (Hager); at 18°, 1.172 (Kohlrausch); at 23°, 1.22 (Schiff); at 30°, 1.342 (Lunge). See also Wegscheider and Walter, 1905, for Sp. Gr. determinations at other temperatures.

EQUILIBRIUM IN THE SYSTEM SODIUM CARBONATE, SODIUM BICARBONATE, AND WATER AT 25°.

(McCoy and Test, 1911.)

(Forty grams of $NaHCO_3$ and about 200 cc. of H_2O were rotated at 25° until equilibrium was reached. Small portions of the clear solution were then analyzed by the Winkler method for carbonate content, and by titration in presence of methyl orange, for sodium. About 15 gms. of $Na_2CO_3.10H_2O$ were then added, and the mixture again rotated until equilibrium was reached, and again analyzed. This was continued and the following results were obtained.)

Per cent of Total Na Present as Bicarbonate.	Gms. Na per Liter.	Gms. Bicarbonate per Liter.	Gms. Carbonate per Liter.	Solid Phase.
0	119.9	0	276.4	$Na_2CO_3.10H_2O$
5.92	127.6	27.6	276.3	" + $Na_2CO_3.NaHCO_3.2H_2O$
7.5	120	...	...	$Na_2CO_3.NaHCO_3.2H_2O$
10	107	...	...	"
12.89	108	50.8	216.6	" + $NaHCO_3$
15	100	...	...	$NaHCO_3$
20	80	...	...	"
32	60	...	...	"
56	40	...	...	"
80	30	...	...	"
100	27.02	98.7	0	"

The following data for this system also at 25°, but given in terms of weight instead of volume of solution, are reported by de Paepe (1911).

Gms. per 100 Gms H_2O Na_2CO_3.	$NaHCO_3$.	Solid Phase.	Gms. per 100 Gms. H_2O. Na_2CO_3.	$NaHCO_3$.	Solid Phase.
28.3	0	$Na_2CO_3.10H_2O$	12.4	7.3	$NaHCO_3$
27.3	2.1	"	6.2	9	
26.5	4.2	" + $NaHCO_3$	1	10.1	
19.2	5.7	$NaHCO_3$			

SOLUBILITY OF SODIUM CARBONATE IN AQUEOUS SOLUTIONS OF SODIUM BROMIDE AND OF SODIUM IODIDE AT 30°.

(Cocheret, 1911.)

In Aq. NaBr Solutions.

Gms. per 100 Gms. Sat. Sol. Na_2CO_3	NaBr.	Solid Phase.
27.98	0	$Na_2CO_3.10H_2O$
27.54	2.41	"
26.72	4.06	"
26.23	6.26	" + $Na_2CO_3.7H_2O$
23.40	11	$Na_2CO_3.7H_2O$
22.68	12.22	"
19.86	16.88	"
19.57	16.95	" + $Na_2CO_3.H_2O$
18.11	19.32	$Na_2CO_3.H_2O$
8.45	33.39	"
6.90	36.13	"
3.04	44.75	"
2.99	45.31	" + $NaBr.2H_2O$
2.60	45.68	$NaBr.2H_2O$
0	49.40	"

In Aq. NaI Solutions.

Gms. per 100 Gms Sat. Sol. Na_2CO_3.	NaI	Solid Phase.
26.5	2.4	$Na_2CO_3.10H_2O$
25.5	4.7	"
24.4	8.6	"
24.3	9.5	" + $Na_2CO_3.7H_2O$
23	11.2	$Na_2CO_3.7H_2O$
20.8	14	"
18.7	18.4	"
15.3	25.4	" + $Na_2CO_3.H_2O$
13.1	29.1	$Na_2CO_3.H_2O$
10.4	33.3	"
4.2	46	"
2.7	51	"
0.9	57.6	"
0.3	65.6	" + $NaI.2H_2O$
0	65.5	$NaI.2H_2O$

Solubility of Sodium Carbonate in Aqueous Solutions of Sodium Chloride at 15°.

(Reich, 1891.)

Gms. per 100 Gms. H_2O. NaCl.	Gms. per 100 Gms. H_2O. $Na_2CO_3.10H_2O$.	Gms. NaCl per 100 Gms. Solution.	Gms. Na_2CO_3 per 100 Gms. NaCl Solution.	Gms. per 100 Gms. H_2O. NaCl.	Gms. per 100 Gms. H_2O. $Na_2CO_3.10H_2O$.	Gms NaCl per 100 Gms. Solution.	Gms. Na_2CO_3 per 100 Gms. NaCl Solution.
0	61.42	0	16.42	23.70	39.06	15.96	9.76
4.03	53.86	2.92	14.47	27.93	39.73	18.26	9.62
8.02	48	5.80	12.87	31.65	41.44	20.06	9.73
12.02	43.78	8.61	11.62	35.46	43.77	21.75	7.95
16.05	40.96	11.31	10.70	37.23	45.27*	22.46	10.13
19.82	39.46	13.71	10.11				

* Both salts in solid phase.

Solubility of Sodium Carbonate in Aqueous Sodium Chloride at 30°.

(Cocheret, 1911.)

Gms per 100 Gms. Sat Sol. Na_2CO_3.	Gms per 100 Gms. Sat Sol. NaCl.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. Na_2CO_3.	Gms. per 100 Gms. Sat. Sol. NaCl.	Solid Phase.
27.98	0	$Na_2CO_3.10H_2O$	20.72	11.49	$Na_2CO_3.H_2O$
27.48	0.90	"	18	14.12	" +NaCl
27.12	3.33	"	14.81	16.26	NaCl
26.82	4.15	" $+Na_2CO_3.7H_2O$	9.71	18.76	"
25.59	5.17	$Na_2CO_3.7H_2O$	5.65	21.94	"
24.26	5.93	"	0	26.47	"
22.75	10.24	" $+Na_2CO_3.H_2O$			

Solubility of Sodium Carbonate in Aqueous Solutions of Sodium Nitrate.

(Kremann and Zitek, 1909.)

t°.	Gms. per 100 Gms. H_2O. Na_2CO_3.	Gms. per 100 Gms. H_2O. $NaNO_3$.	Solid Phase.	t°.	Gms per 100 Gms. H_2O. Na_2CO_3.	Gms per 100 Gms. H_2O. $NaNO_3$.	Solid Phase.
10	11.98	0	$Na_2CO_3.10H_2O$	24.2	24.63	54.43	$Na_2CO_3.7H_2O$
10	8.75	70.48	" $+NaNO_3$	24.2	21.8	62.7	" $+NaNO_3$
10	0	80.5	$NaNO_3$	24.2	5.96	84.45	$NaNO_3$
24.2	28.55	0	$Na_2CO_3.10H_2O$	24.2	0	91.3	"
24.2	26.33	45.96	" $+Na_2CO_3.7H_2O$				

Solubility of Sodium Carbonate in Aqueous Ethyl Alcohol at 30°.

(Cocheret, 1911.)

Gms. per 100 Gms. Sat. Sol. Na_2CO_3.	Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. Na_2CO_3.	Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	Solid Phase.
26.61	2.64	$Na_2CO_3.10H_2O$	0.40	63.20	$Na_2CO_3.7H_2O$
26.14	3.41*	"	0.11	73.06	" $+Na_2CO_3.H_2O$
1.38	44.81*	"	0.07	78.19	$Na_2CO_3.H_2O$
0.62	52.99	"	0.06	90.95	"
0.53	55.70	" $+Na_2CO_3.7H_2O$	0.03	95.06	" $+Na_2CO_3$
0.51	56.56	$Na_2CO_3.7H_2O$	...	98.46	Na_2CO_3

* Between these two concentrations, the mixtures separate into two liquid layers.

Results are also given for the solubility of Na_2CO_3 + NaBr and of Na_2CO_3 + NaCl in Aq. C_2H_5OH at 30°.

Solubility of Sodium Carbonate in Aqueous Solutions of Ethyl and of Propyl Alcohol at 20°.

(Linebarger, 1892.)

Wt. Per cent Alcohol.	Gms. Na_2CO_3 per 100 Gms Sol. In Ethyl.	Gms. Na_2CO_3 per 100 Gms Sol. In Propyl.	Wt. Per cent Alcohol.	Gms. Na_2CO_3 per 100 Gms. Sol. In Ethyl.	Gms. Na_2CO_3 per 100 Gms. Sol. In Propyl.
28	...	4.4	48	0.9	1.3
38	...	2.7	50	0.84	1.2
44	1.7	1.7	54	0.80	0.9
46	1.13	1.5	62	...	0.4

Solubility of Sodium Carbonate in Aqueous Solutions of Ethyl Alcohol.

(Ketner, 1901–02.)

Note. — The mixtures were so made that alcoholic and aqueous layers were formed, and these were brought into equilibrium with the solid phase.

t°.	Gms. per 100 Gms. Alcoholic Layer.			Gms. per 100 Gms. Aq. Layer.			Solid Phase.
	C_2H_5OH.	Na_2CO_3.	H_2O.	C_2H_5OH.	Na_2CO_3.	H_2O.	
35	62.9	0.3	36.8	1	32.4	66.6	$Na_2CO_3.H_2O$
40	61	0.4	38.6	1.2	31.9	66.9	"
49	61	0.4	38.6	1.2	31.5	67.3	"
68	55.8	0.9	43.3	2.3	28.8	68.9	"
31.2	52.4	0.8	46.8	...	29.3	...	$Na_2CO_3.7H_2O$ (β)
31.9	54.8	0.7	44.5	1.7	29.8	68.5	"
32.3	56.1	0.6	43.3	1.5	30.2	68.3	"
33.2	58.1	0.5	42.4	1.4	31	67.6	"
27.7	Crit. sol. ± 14% C_2H_2OH ± 13% Na_2CO_3 ± 73% H_2O						
28.2	23.5	7.3	69.2	7.9	18.6	73.5	$Na_2CO_3.10H_2O$
29	32.7	3.8	63.5	4.3	22.7	73.0	"
29.7	40	2.1	57.9	2.9	25.5	71.6	"
30.6	47.8	1.2	51	2.3	27.8	69.9	"

Solubility of $Na_2CO_3.10H_2O$ in Dilute Alcohol at 21°.

(Ketner.)

Gms. per 100 Gms. Solution.			Gms. per 100 Gms. Solution.		
Na_2CO_3.	C_2H_5OH.	H_2O.	Na_2CO_3.	C_2H_5OH.	H_2O.
18.5	0	81.5	1.2	39.2	59.6
12.7	6.2	81.1	0.2	58.2	41.6
6.9	15.3	77.8	0.1	67.1	32.8
3.2	26.1	70.7	0.06	73.3	26.64

Isotherms showing the compositions of the conjugated liquids at 28.2°, 29.7° and 40° are also given.

Equilibrium in the System Sodium Carbonate, Normal Propyl Alcohol and Water at 20°.

(Frankforter and Temple, 1915.)

(Note. In this paper the results for the binodal curve are reported in terms of gms. per 100 gms. solvent (water + alcohol), instead of gms. per 100 gms. of the homogeneous liquid (sodium carbonate + water + alcohol.)

Gms. per 100 Gms. Alcohol + Water.			Gms. per 100 Gms. Alcohol + Water.		
Na_2CO_3.	Alcohol.	Water.	Na_2CO_3.	Alcohol.	Water.
16.568	3.409	96.591	1.990	31.537	68.463
15.363	4.472	95.528	1.338	40.796	59.204
11.696	6.595	93.405	0.930	46.933	53.067
8.415	9.176	90.824	0.567	53.875	46.125
6.669	11.221	88.779	0.298	59.507	40.493
4.138	15.785	84.215	0.160	63.568	36.432
2.878	21.099	78.901	0.109	75.159	24.841

For results on the system sodium carbonate, allyl alcohol, water at 20° see last table, p. 647.

100 gms. glycerol (d_{15} = 1.256) dissolve 98.3 gms. Na_2CO_3 at 15°–16°. (Ossendowski, 1907.)

100 gms. saturated solution in glycol contain 3.28–3.4 gms. sodium carbonate. (de Coninck, 1905.)

100 gms. H_2O dissolve 229.2 gms. sugar + 24.4 gms. Na_2CO_3, or 100 gms. sat. aq. solution contain 64.73 gms. sugar + 6.89 gms. Na_2CO_3 at 31.25°. (Köhler, 1897.)

Equilibrium in the System Sodium Carbonate, Pyridine, Water.

(Limbosch, 1909.)

Very pure materials were used. The boiling-point (cor.) of the pyridine was 115°–115.07°. Increasing amounts of this pyridine were added to aqueous solutions of sodium carbonate contained in glass tubes. After the tubes were sealed they were placed in a bath and the temperature noted at which the liquid mixture passed from a homogeneous to an opalescent condition. During the observation, the contents of the tubes were stirred by means of pieces of iron, moved with the aid of a magnet on the outside of the tube.

Per cent of Na_2CO_3.	Per cent of Pyridine.	t° of Sat.	Per cent of Na_2CO_3	Per cent of Pyridine.	t° of Sat.	Per cent of Na_2CO_3.	Per cent of Pyridine.	t° of Sat.
0.129	66.2	12	2.50	50	199	6.12	23.5	120
0.129	66.4	25	2.50	53.3	197	6.12	25.5	132
0.129	67.7	36	2.50	59.4	173	6.12	28.4	152
0.129	69.2	44	2.50	69.2	123	6.99	13.8	54.2(40.5)
0.129	73.5	53	2.50	73.8	110	6.99	15.4	81 (17)
0.129	74.8	51.5	2.50	74.8	*	6.99	19.5	117
0.129	76.1	25.5(−64)	3.49	30.3	−0.5	6.99	22.7	142
0.129	77.8	11 (−59)	3.49	32.6	39	6.99	25.1	158
1.01	47.6	17	3.49	34.3	86.5	6.99	27.6	169
1.01	49.9	36	3.49	36.7	107	6.99	32.6	180+
1.01	51.2	55	3.49	37.4	123	9.36	8.50	64 (26)
1.01	52.2	72	3.49	42.5	194	9.36	9	78 (18)
1.01	56.1	107	3.49	69.6	167	9.36	11.4	106.5
1.01	60.6	111	3.49	71.2	*	9.36	13.8	127
1.01	66.8	110	5.23	23.3	63(27.5)	9.36	16.3	148
1.01	75.1	86.5	5.23	23.7	70(20.5)	9.36	20.1	169
1.01	76.9	71	5.23	24.6	79	9.36	25	180+
1.01	78.1	*	5.23	26.2	96	9.36	50	180+
2.50	36.3	22	5.23	28.7	111	18.1	2.12	48 (18)
2.50	37.9	53.25	5.23	32.5	155	18.1	2.25	66
2.50	39.2	74.5	5.23	36.6	196	18.1	2.70	79
2.50	40	94	5.23	37.2	200+	18.1	4.20	108
2.50	43.6	147	5.23	55.4	*	18.1	5.40	126
2.50	47.6	185				18.1	6.80	155

* Precipitate of Na_2CO_3. Results in parentheses show lower temperatures of saturation.

Fusion-point data for Na_2CO_3 + NaCl are given by Le Chatelie (r1894) and Sackur (1911–12). Results for Na_2CO_3 + Na_2SO_4 are given by Le Chatelier (1894), Sackur (1911–12) and by Amadori (1912). Results for Na_2CO_3 + KCl are given by Sackur (1911–12).

SODIUM (Bi) **CARBONATE** $NaHCO_3$.

Solubility in Water.

(Dibbits, 1874; Fedoticff, 1904.)

t°.	Gms. $NaHCO_3$ per 100 Gms. Water.	Gms. $NaHCO_3$ per 100 Gms. Solution.	t°.	Gms. $NaHCO_3$ per 100 Gms. Water.	Gms. $NaHCO_3$ per 100 Gms. Solution.
0	6.9	6.5	30	11.1	10
10	8.15	7.5	40	12.7	11.3
20	9.6	8.8	50	14.45	12.6
25	10.35	9.4	60	16.4	13.8

100 gms. H_2O dissolve 9.03 gm. $NaHCO_3$ at 15°, d_{15} = 1.061.
(Greenish and Smith, 1901.)

100 gms. alcohol of 0.941 Sp. Gr. dissolve 1.2 gms. $NaHCO_3$ at 15.5°

100 gms. glycerol dissolve 8 gms. $NaHCO_3$ at 15.5°. (Ossendowski, 1907.)

SOLUBILITY OF SODIUM BICARBONATE IN AQUEOUS AMMONIUM BICARBONATE SOLUTIONS SATURATED WITH CO_2.

(Fedotieff, 1904.)

t°.	Wt. of 1 cc. Solution.	Mols. per 1000 Gms. H_2O.		Grams per 1000 Gms. H_2O.	
		NH_4HCO_3.	$NaHCO_3$.	NH_4HCO_3.	$NaHCO_3$.
0	1.072	1.39	0.58	109.4	48.2
"	...	0 0	0.82	0.0	69.0
15	1.056	0 0	1.05	0.0	88.0
"	1.061	0.29	0 95	23.0	80.0
"	1.065	0.56	0.89	44.0	74.6
"	1.073	1.08	0.79	85.7	66.7
"	1.090	2.16	0.71	170.6	59.2
30	...	0.0	1.65	0.0	138.6
"	...	2.91	0.83	230	70.0

SOLUBILITY OF SODIUM BICARBONATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE SATURATED WITH CO_2.

(Fedotieff; see also Reich, 1891)

t°.	Wt. of 1 cc. Solution.	Mols per 1000 Gms H_2O.		Grams per 1000 Gms. H_2O.	
		NaCl.	$NaHCO_3$.	NaCl	$NaHCO_3$.
0	..	0.0	0 82	0 0	69 0
"	1.208	6.0	0.09	350.1	7.7
15	1.056	0.0	1.05	0.0	88.0
"	1.063	0.52	0.82	30 2	68.6
"	1.073	1.03	0.64	60 1	53.6
"	1.096	2.11	0.41	123 1	34.8
"	1.127	3 20	0.28	187.2	23.0
"	1.158	4.39	0 19	256.9	16.1
"	1.203	6.06	0 12	354.6	10 0
30	1.066	0.0	1.31	0 0	110.2
"	1.079	1 02	0.87	59 9	72.8
"	1.100	2 08	0.56	121 9	47.3
"	1.127	3 18	0.38	186.3	32.0
"	1.156	4 38	0.27	256 0	22 3
"	1.199	6.12	0 17	358.1	13.9
45	1.077	0.0	1.65	0.0	138.6
"	1.086	1.04	1 12	60.7	94.0
"	1.115	2.65	0.62	155.2	52.0
"	1.127	3.24	0.52	189.4	43.4
"	1.155	4.38	0.37	256.1	30.7
"	1.198	6.18	0.23	361.5	19.5

100 gms. alcohol of 0.941 Sp. Gr. dissolve 5.55 gms. sodium sulfocarbonate at 15.5°.

SOLUBILITY OF SODIUM BICARBONATE IN AQUEOUS SODIUM NITRATE SOLUTIONS.

(Fedotieff and Koltunoff, 1914.)

t°.	Sp. Gr. of Sat. Sol.	Gms. per 100 Gms. H_2O.	
		$NaNO_3$.	$NaHCO_3$.
0	1.356	72.74	1.41
15	1.183	29.06	3.40
15	1.285	54.56	2.16
15	1.377	83.20	1.57
30	...	95.14	1.80

SODIUM CHLORATE $NaClO_3$.

SOLUBILITY IN WATER.

(Carlson, 1910; Le Blanc and Schmandt, 1911; Osaka, 1903–08.)

t°.	d of Sat. Sol.	Gms. $NaClO_3$ per 100 Gms. H_2O.	t°.	d of Sat. Sol.	Gms. $NaClO_3$ per 100 Gms. H_2O.
−15	1.380	72	40	1.472	126 (115 Le B. & S.)
0	1.389	79 (80 Le B. & S.)	50	...	140 (126 ")
10	...	89 (87 ")	60	1.514	155
15	1.419	95 (91 ")	70	...	172
20	1.430	101 (95.7 ")	80	1.559	189
25	1.44	106 (101 O.)	100	1.604	230
30	...	113 (105 Le B. & S.)	122 (b. pt.)	1.654	286

The earlier data of Kremers (1856) lie between the values of Carlson and of Le Blanc and Schmandt.

SOLUBILITY OF SODIUM CHLORATE IN AQUEOUS SODIUM CHLORIDE SOLUTIONS AT 20°.

(Winteler, 1900)

Sp. Gr. of Solutions.	Gms. per Liter NaCl.	Gms. per Liter $NaClO_3$	Sp. Gr. of Solutions.	Gms. per Liter. NaCl.	Gms. per Liter. $NaClO_3$.
1.426	5	668	1.365	175	393
1.419	25	638	1.345	200	338
1.412	50	599	1.319	225	271
1.405	75	559	1.289	250	197
1.398	100	522	1.256	275	120
1.389	125	484	1.235	290	78
1.379	150	442	1.217	300	55

100 gms. H_2O dissolve 24.4 gms. NaCl + 50.75 gms. $NaClO_3$ at 12°.
100 gms. H_2O dissolve 11.5 gms. NaCl + 249.6 gms. $NaClO_3$ at 122°. (Schlosing, 1871.)

SOLUBILITY OF SODIUM CHLORATE IN AQUEOUS ETHYL ALCOHOL.

(Carlson, 1910)

t°.	Gms. $NaClO_3$ per Liter of Sat. Sol. in Aqueous Alcohol of: 50 Per cent.	75 Per cent	90 Per cent.
20	313.3	110.8	16.1
40	321.8	133.5	22.9
60	326.8	155.8	29
70	...	161.3	...

100 gms. alcohol of 77 Wt. per cent dissolve 2.9 gms. $NaClO_3$ at 16°. (Wittstein.)
100 gms. alcohol dissolve 1 gm. $NaClO_3$ at 25°, and 2.5 gms. at b. pt.
100 gms. glycerol dissolve 20 gms. $NaClO_3$ at 15.5°. (Ossendowski, 1907.)
100 cc. anhydrous hydrazine dissolve 66 gms. $NaClO_3$ at room temperature. (Welsh and Broderson, 1915.)

SODIUM PerCHLORATE $NaClO_4.H_2O$.

SOLUBILITY IN WATER.

(Carlson, 1910)

t°.	d of Sat. Solution	Gms. $NaClO_4$ per 100 cc. Sat. Solution.	Solid Phase.
15	1.666	107.6	$NaClO_4.H_2O$
50	1.731	123.4	"
143	1.789	141.4	$NaClO_4$

SODIUM CHLORIDE NaCl.

SOLUBILITY IN WATER.

(Mulder; de Coppet, 1883; Andræ, 1884; Raupenstrauch, 1885; above 100°, Tilden and Shenstone, 1884; Berkeley, 1904; Etard, 1894, gives irregular results.)

t°.	Gms. NaCl per 100 Gms. H_2O.		Gms. NaCl per 100 g. Sol.	t°.	Gms. NaCl per 100 Gms. H_2O.		Gms. NaCl per 100 g. Sol.
0	35.7*	35.63†	26.28†	70	37.8*	37.51†	27.27†
10	35.8	35.69	26.29	80	38.4	38.00	27.54
20	36.0	35.82	26.37	90	39.0	38.52‡	27.80
25	36.12	35.92	26.43	100	39.8	39.12‡	28.12
30	36.3	36.03	26.49	118		39.8	28.46
40	36.6	36.32	26.65	140		42.1	29.63
50	37.0	36.67	26.83	160		43.6	30.37
60	37.3	37.06	27.04	180		44.9	30.98

* M.; de C. † A. ‡ B.

The original, very carefully determined figures of Berkeley, are as follows:

t°.	d of Sat. Sol.	Gms. NaCl per 100 Gms. H_2O.	t°.	d of Sat. Sol.	Gms. NaCl per 100 Gms. H_2O.
0.35	1.2090	35.75	61.70	1.1823	37.28
15.20	1.2020	35.84	75.65	1.1764	37.82
30.05	1.1956	36.20	90.50	1.1701	38.53
45.40	1.1891	36.60	.07 b. pt.	1.1631	39.65

100 gms. H_2O dissolve 35.99 gms. NaCl at 30°. (Cocheret, 1911.)

SOLUBILITY OF SODIUM CHLORIDE IN WATER, DETERMINED BY THE FREEZING-POINT METHOD.

(Matignon, 1909a.)

t°.	Gms. NaCl per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. NaCl per 100 Gms. H_2O.	Solid Phase.
−0.4	0.69	Ice (Raoult)	−12.7	20	Ice
−0.8	1.37	" (Biltz)	−16.66	25	"
−2.86	4.9	" (Kahlenberg)	−21.3	30.7	" $+NaCl.2H_2O$
−3.42	5.85	" (Raoult)	−14	32.5	$NaCl.2H_2O$ (de Coppet)
−6.6	11	"	−12.25	32.9	" (Matignon)
−9.25	15	"	− 6.25	34.22	" (de Coppet)

Data for the influence of pressure on the solubility of sodium chloride in water are given by v. Stackelberg (1896); Cohen, Inouye, and Euwen (1910) and by Sill (1916).

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS SIMULTANEOUSLY SATURATED WITH OTHER SALTS.

The various papers of J. H. van't Hoff and collaborators, on this subject, have been collected by H. Precht and E. Cohn in a volume entitled "Untersuchungen über die Bildungsverhältnisse die Ozeanischen Salzablagerungen," Leipzig, 1912, p. 374. By far the larger part of the new data in these papers are for solutions simultaneously saturated with three or more salts and are, therefore, beyond the limits of complexity of mixture, set for the present volume. The various systems are described in detail and diagrams are given. A table summarizing much of the data (van't Hoff (1905)) is given on the following page.

Solubility of Sodium Chloride in Aqueous Solutions Simultaneously Saturated with Other Salts at 25°.

(van't Hoff, 1905.)

Mols. per 1000 Mols. H_2O.					Solution Saturated with Respect to NaCl and:
Na_2Cl_2.	K_2Cl_2.	$MgCl_2$.	$MgSO_4$.	Na_2SO_4.	
1	0.5	105	...	...	$MgCl_2.6H_2O$ + Carnallite
2	5.5	70.5	...	...	KCl + Carnallite
44	20	...	...	4.5	" + Glaserite
44	10.5	...	...	14.5	Na_2SO_4 + "
46	...	...	16.5	3.0	" + Astrakanite
26	...	7	34	...	$MgSO_4.7H_2O$ + Astrakanite
4	...	67.5	12	...	" + $MgSO_4.6H_2O$
2.5	...	79	9.5	...	Kieserite + "
1	...	101	5	...	" + $MgCl_2.6H_2O$
23	14	21.5	14	...	KCl + Glaserite + Schönite
19.5	14.5	25.5	14.5	...	" + Leonite + "
9.5	9.5	47	14.5	...	" + " + Kainite
2.5	6	68	5	...	" + Carnallite + "
1	1	85.5	8	...	Kieserite + Carnallite + Kainite
42	8	...	16	6	Na_2SO_4 + Glaserite + Astrakanite
27.5	10.5	16.5	18.5	...	Schönite + Glaserite + Astrakanite
22	10.5	23	19	...	Leonite + Glaserite + Astrakanite
10.5	7.5	42	19	...	" + $MgSO_4.7H_2O$ + Astrakanite
9	7.5	45	19.5	...	" + " + Kainite
3.5	4	65.5	13	...	$MgSO_4.6H_2O$ + " + "
1.5	2	77	10	...	$MgSO_4.6H_2O$ + Kieserite + "
1	0.5	100	5	...	Carnallite + $MgCl_2.6H_2O$ + "
1	0.5	105	...	...	$MgCl_2.6H_2O$ + Carnallite
2	5.5	70.5	...	...	KCl + "
			$CaCl_2$.		
1	...	51.5	90.5	...	$MgCl_2.6H_2O$ + Tachhydrite
1	11	...	146	...	KCl + $CaCl_2.6H_2O$
1	...	35.5	121.5	...	Tachhydrite + $CaCl_2.6H_2O$
1	1.5	50.5	90.5	...	$MgCl_2.6H_2O$+Tachhydrite+Carnallite
1	9.5	5	141.5	...	$CaCl_2.6H_2O$ + KCl + Carnallite
1	2	34.5	121.5	...	$CaCl_2.6H_2O$+Tachhydrite+Carnallite

Carnallite = $KMgCl_3.6H_2O$, Glaserite = $K_3Na(SO_4)_2$, Astrakanite = $Na_2Mg(SO_4)_2.4H_2O$, Kieserite = $MgSO_4.H_2O$, Leonite = $MgK_2(SO_4)_2.4H_2O$, Schönite = $MgK_2(SO_4)_2.6H_2O$, Kainite = $MgSO_4.KCl.3H_2O$.

Solubility of Sodium Chloride in Aqueous Solutions of Ammonium Chloride.

(Fedotieff, 1904.)

t°.	Wt. of 1 cc. Solution.	Mols. per 1000 Gms. H_2O.		Gms. per 1000 Gms. H_2O.	
		NH_4Cl.	NaCl.	NH_4Cl.	NaCl.
0	...	0	6.09	0	356.3
"	1.185	2.73	4.89	146.1	286.4
15	1.200	0	6.12	0	357.6
"	1.191	1.07	5.58	57.3	326.4
"	1.183	2.22	5.13	118.9	300
"	1.176	3.48	4.64	186.4	271.6
"	1.175	3.72	4.55	198.8	266.8
30	...	0	6.16	0	360.3
"	1.166	4.77	4.26	255.4	249
45	...	0	6.24	0	365
"	...	6.02	4	322.1	233.9

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS AMMONIA AT 30°.

(Hempel and Tedesco, 1911.)

d_{30} of Sat. Sol.	Gms. per 1000 cc. Sat. Sol. NH₃.	NaCl.	d_{30} of Sat. Sol.	Gms. per 1000 cc. Sat. Sol. NH_3.	NaCl.
1.1735	29.535	293.38	1.1406	72.07	283.38
1.1656	40.655	292.5	1.1395	72.715	283.06
1.160	47.26	289.7	1.1301	81.855	277.49
1.1494	60.78	286.5	1.1205	97.49	270.57

Data for equilibrium in the system sodium chloride, arsenic trioxide, water, at 30°, are given by Schreinemakers and deBaat (1915).

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID.

(Engel, 1888; Enklaar, 1901.)

At 0°. (Engel.)

Mg. Mols. per 10 cc. HCl.	NaCl.	Sp. Gr. of Solution.	Gms. per Liter. HCl.	NaCl.
0.0	54.7	1.207	0.0	32.0
1.0	53.5	1.204	0.365	31.3
1.85	52.2	1.202	0.674	30.5
5.1	48.5	1.196	1.859	28.4
9.28	44.0	1.185	3.38	25.7
15.05	37.9	1.173	5.49	22.2
30.75	23.5	1.141	11.20	13.7
56.35	6.1	1.119	20.54	3.6

At 10°–10.5°. (Enklaar.)

Mols. per Liter. HCl.	NaCl.	Grams per Liter. HCl.	NaCl.
0.0	6.11	0.0	35.77
0.27	5.77	9.84	33.76
0.35	5.67	12.76	33.19
0.43	5.59	15.68	32.71
0.57	5.43	20.78	31.77
0.72	5.28	26.06	30.89
2.60	3.42	94.77	20.01
2.80	3.18	102.1	19.04
3.31	2.74	120.6	16.03

Results at 0° and at 25°.

(Armstrong and Eyre, 1910–11.)

Gms. HCl per Liter of Solvent.	Gms. NaCl per 100 Gms. Sat. Sol. At 0°.	At 25°.
0	26.35	26.52 (d_{25} = 1.2018)
9.11	25.30	25 45 (d_{25} = 1.1970)
18.22	24.15	25.42 (d_{25} = 1.1915)
36.45	21.93	22 34 (d_{25} = 1.1822)
182.25	...	7.04 (d_{25} = 1.1238)

Results at 25°. (Herz, 1911–12.)

Mols per Liter. HCl.	NaCl.
0.607	4.850
1.032	4.467
1.590	3.782
2.117	3.297
3.283	2.343

Results at 30°. (Schreinemakers, 1909–10.)

Gms. per 100 Gms. Sat. Sol. HCl.	NaCl.
0	26.47
6.93	16.16
12.50	9.35
17.35	4.52
35.60	0.11

Results at 30°. (Masson, 1911.)

d_{30} of Sat. Sol.	Gm Mols per Liter. HCl.	NaCl.	d_{30} of Sat. Sol.	Gms Mols. per Liter. HCl.	NaCl.
1.2018	0	5.400	1.1427	3.052	2.463
1.1906	0.4575	4.932	1.1289	4.152	1.628
1.1801	0.969	4.386	1.1188	5.950	0.630
1.1633	1.786	3.589	1.1258	7.205	0.268
1.1512	2.412	2 978			

In the case of the results of Masson equilibrium was approached from above and the solutions were kept in a thermostat and shaken occasionally during 2–6 days.

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS CALCIUM CHLORIDE SOLUTIONS AT 25°.

(Mills and Wells, 1918.)

d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat Sol. $CaCl_2$.	NaCl.	d_{25} of Sat. Sol.	Gms. per 100 Gms. Sat. Sol. $CaCl_2$.	NaCl.
1.207	1.103	25.30	1.225	9.50	17.55
1.210	2.160	24.32	1.233	11.48	15.91
1.209	3.220	23.37	1.241	17.77	10.54
1.216	5.451	20.43	1.257	21	8.05
1.220	7.398	19.17	1.276	24.58	5.63

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS POTASSIUM NITRATE AT 25.°
(Ritzel, 1911.)

Gms. per 100 cc. Sat. Sol. KNO_3.	NaCl.	Gms. per 100 cc. Sat. Sol. KNO_3.	NaCl.
0	31.80	12	30.86
4	32.26	16	30.45
8	31.85	20	30.10

Data for the solubility of NaCl in aqueous $MgCl_2$ solutions are given by Feit and Przibylla (1909.)

SOLUBILITY OF MIXTURES OF SODIUM CHLORIDE AND OTHER SALTS IN WATER, ETC.

Solvent.	t°.	Gms. per 100 Gms. Solvent.		Authority.
Water	17	26.4	$NaCl + 22.1 NH_4Cl$*	(Karsten.)
"	17	34.5	" $+ 4.1 BaCl_2$	"
"	?	38.3	" $+ 29.5 KNO_3$	"
"	25	38.5	" + 41.14 "	(Soch — J. Physic. Ch. 2, 46, '98.)
"	80	39.81	" + 168.8 "	"
Alcohol (40%)	25	15 78	" + 13.74 "	"
Water	20	30.54	" + 13.95 KCl	(Quoted by Euler — Z. physik. Ch. 49, 315, '04.)
"	25	28.90	" + 16.12 "	

* Sp. Gr. of solution at 17° = 1.179.

SOLUBILITY OF MIXTURES OF SODIUM CHLORIDE AND POTASSIUM SULFATE IN WATER AT VARIOUS TEMPERATURES.
(Precht and Wittgen, 1882)

t°.	Grams per 100 Grams H_2O. NaCl	K_2SO_4	KCl	t°.	Grams per 100 Grams H_2O. NaCl	K_2SO_4	KCl
10	33.4	8.1	3.2	60	36.4	11 9	2.7
20	34 0	8 9	3.1	70	36 6	12.8	3.2
30	34.6	9.6	2.9	80	36.0	12.3	5.1
40	35.2	10.4	2 8	90	35.9	12.4	7.0
50	35 8	11.1	2.8	100	35.6	12.6	8.8

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SODIUM BICARBONATE SATURATED WITH CO_2. (Fedotieff 1904)

t°.	Wt of 1 cc. Solution.	Mols per 1000 Gms H_2O. $NaHCO_3$	NaCl	Gms per 1000 Gms H_2O. $NaHCO_3$.	NaCl.
0	...	0	6.09	0	356.3
"	1.208	0.09	6	7.7	350.1
15	1.203	0	6.12	0	357.6
"	1.203	0.12	6.06	10	354.6
30	1.196	0	6.16	0	360.3
"	1.199	0.17	6.12	13.9	358.1
45	1.189	0	6.24	0	365
"	1.198	c.23	6.18	19.5	361.5

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SODIUM HYDROXIDE AT 30°.
(Schreinemakers, 1909-10, 1910)

Gms. per 100 Gms. Sat. Sol. Na_2O.	NaCl.	Solid Phase.	Gms per 100 Gms Sat. Sol. Na_2O.	NaCl.	Solid Phase.
0	26.47	NaCl	29.31	2.40	NaCl
4.47	21.49	"	37.85	1.12	"
12.22	13.62	"	41.42	0.97	" $+NaOH.H_2O$
24.48	4.36	"	±42	0	$NaOH.H_2O$

Solubility of Sodium Chloride in Aqueous Sodium Hydroxide Solutions.

(Engel; Winteler, 1900.)

At 0° (Engel).

Mg. Mols. per 10 cc. Na_2O.	Mg. Mols. per 10 cc. NaCl.	Sp. Gr. of Solutions.	Gms. per Liter. NaOH.	Gms. per Liter. NaCl.
0	54.7	1.207	0	320
4.8	49.38	1.221	38.4	288.9
6.73	47.21	1.225	53.8	276.2
10.41	42.38	1.236	183.2	247.9
14.78	39.55	1.249	118.2	231.4
30.50	24.95	1.295	244	146
37.88	19.30	1.314	303	112.9
53.25	9.41	1.362	426	55

At 20° (Winteler).

Gms. per Liter. NaOH.	Gms. per Liter. NaCl.	Sp. Gr. of Solutions.
10	308	1.200
50	297	1.230
100	253	1.250
150	213	1.270
200	173	1.290
300	112	1.330
400	61	1.375
500	30	1.425
640	18	1.490

Solubility of Sodium Chloride in Aqueous Solutions of Sodium Nitrate and Vice Versa.

(Bodländer, 1891; Nicol, 1891; results at 25° by Soch, 1898.)

$NaCl$ in Aqueous $NaNO_3$. Results at 15.5° (B.).

Sp. Gr. of Solutions.	Gms. per 100 cc. Sat. Solution. $NaNO_3$.	H_2O.	NaCl.
1.2025	0	88.47	31.78
1.2305	7.53	87.63	27.89
1.2580	13.24	86.25	26.31
1.2810	21 58	82.66	23.98
1.3090	28.18	80.42	22.30
1.3345	33.80	79.25	20.40
1.3465	37.88*	77.37	19.40*
1.3465	37.64*	77.34	19.67*

$NaNO_3$ in Aqueous NaCl. Results at 15° (B.).

Sp. Gr. of Solutions.	Gms per 100 cc. Sat. Solution. NaCl.	H_2O.	$NaNO_3$.
1.3720	0	74.82	62.38
1.3645	4.0	75.69	56.76
1.3585	7.24	75.71	52.09
1.3530	11.36	76.86	47.08
1.3495	15.33	76.96	42.66
1.3485	17 81	77.14	39.90
1.3485	18.97*	77.15	38.73*
1.3485	19.34*	77.49	38.02*

Results at 20° (N.).

Grams per 100 Grams H_2O.			
0	$NaNO_3$	35.91	NaCl
14.17	"	32.82	"
28.33	"	29.78	"
42.50	"	26.91	"
54.63*	"	24.92*	"

Grams per 100 Grams H_2O.			
0	NaCl	87.65	$NaNO_3$
6.5	"	77.34	"
13.0	"	68.50	"
19.5	"	60.49	"

100 gms. H_2O dissolve 43.66* gms. $NaNO_3$ + 26.58* gms. NaCl at 25°.
100 gms. H_2O dissolve 121.6* gms. $NaNO_3$ + 17.62* gms. NaCl at 80°.
100 gms. aq. alcohol of 40 wt. per cent dissolve 22.78 gms. $NaNO_3$ + 10.17 gms. NaCl at 25°.

* Indicates solutions saturated with both salts.

Solubility of Sodium Chloride in Aqueous Solutions of Sodium Nitrate and Vice Versa.

(Leather and Mukerji, 1913.)

Results at 30°.			Results at 40°.			Results at 91°.			
d_{30} of Sat. Sol.	Gms. per 100 Gms. H_2O.		d_{40} of Sat. Sol.	Gms. per 100 Gms. H_2O.		d_{91} of Sat. Sol.	Gms. per 100 Gms. H_2O.		Solid Phase in Each Case.
	$NaNO_3$.	NaCl.		$NaNO_3$.	NaCl.		$NaNO_3$.	NaCl.	
1.202	0	36.3	1.197	0	36.53	1.189	0	38.72	NaCl
1.276	24.21	31.16	1.284	27.31	30.53	1.296	37.43	30.21	"
1.343	48.15	26.35	1.323	54.82	26.50	1.381	79.65	23.17	"
1.379	63.08	23.50	1.409	73.96	21.87	1.487	127.2	17.05	"
1.388	63.40	23.40	1.397	74.01	21.71	1.519	141.4	15.93	" + $NaNO_3$
1.381	67.91	19.69	1.396	75.29	21.61	1.518	141.3	15.83	" $NaNO_3$
1.394	81.46	9.76	1.410	89.90	10.80	1.504	149.5	9.03	"
1.406	95.90	0	1.421	105.2	0	1.521	160.8	0	"

Results are also given at 20° which agree satisfactorily with those of Nicol. Additional results at 30°, agreeing fairly well with the above, are given by Coppadoro (1913). Data for the solubility of sodium chloride in dilute solutions of sodium nitrate at 0° and at 25° are given by Armstrong and Eyre (1910–11).

Solubility of Sodium Chloride in Aqueous 7.45 per cent Sodium Sulfate Solutions.

(Marie and Marquis, 1903.)

t°.	Gms NaCl per 100 Gms. Sat. Sol	t°.	Gms. NaCl per 100 Gms. Sat. Sol.
14.8	23.30	27.75	23.525
17.9	23.33	32.18	23.55
25.6	23.485	34.28	23.68

For additional data on this system see sodium sulfate, pp. 669 and 670.

Solubility of Sodium Chloride in Aqueous Solutions of Ethyl Alcohol.

(Armstrong and Eyre, 1910–11.)

Results at 0°.		Results at 25°.		
Solvent Gms. C_2H_5OH per 1000 Gms. H_2O.	Gms NaCl per 100 Gms. Sat. Sol	d_{25} of Sat. Sol.	Solvent Gms. C_2H_5OH per 1000 Gms. H_2O.	Gms. NaCl per 100 Gms. Sat. Sol.
0	26.46	1.202	0	26.55
11.51	25.97	1.196	11.51	26.06
23.03	25.48	1.190	23.03	25.63
46.06	24.41	1.179	46.06	24.75
138.18	20.95	1.159	92.12	23.29
		1.1115	230.3	19.35

Solubility of Sodium Chloride in Aqueous Alcohol at 28°.

(Fontein, 1910.)

Gms. per 100 Gms. Sat. Sol.			Gms. per 100 Gms. Sat. Sol.		
C_2H_5OH.	H_2O.	NaCl.	C_2H_5OH.	H_2O.	NaCl.
0	73.53	26.47	45.35	45.35	9.3
3.8	71.6	24.6	56.2	37.5	6.3
7.7	69.7	22.6	67.4	28.9	3.7
16.1	64.6	19.3	78.8	19.7	1.5
25.3	58.9	15.8	89.6	10	0.4
35	52.5	12.5			

Results are also given by Fontein showing the solubility of sodium chloride in mixtures of ethyl alcohol, amyl alcohol and water at 28°, both when one liquid phase is present and when conjugated liquid layers are formed.

Solubility of Sodium Chloride in Alcohols.

(At 18.5°, de Bruyn — Z. physik. Ch. 10, 782, '92; Rohland — Z. anorg. Ch. 18, 327, '98.)

t°.	Alcohol.	Gms. NaCl per 100 Gms. Alcohol.	t°.	Alcohol	Gms. NaCl per 100 Gms. Alcohol.
18.5	Abs. Methyl	1.41	room temp.	Methyl d_{15}=0.799	1.33
"	" Ethyl	0.065	"	Ethyl d_{15} =0.81	0.176
			"	Propyl d_{15} =0.816	0.033

Solubility of Sodium Chloride in Aqueous Ethyl Alcohol Solutions.

(Bodländer — Z. physik. Ch. 7, 317, '91; Taylor — J. Phys. Ch. 1, 723, '97; also Bathrick — *Ibid.* 1, 159, '96.)

Results at 11.5° (B.).

Sp. Gr. of Solutions.	Gms. per 100 cc. Solution. C_2H_5OH.	H_2O.	NaCl.
1.2035	0	86.62	31.73
1.1865	2.86	86.14	29.66
1.1710	5.41	83.93	27.77
1.1548	7.93	81.50	26.05
1.1350	10.84	78.78	24.28
1.1390	11.22	78.62	23.65
1.1088	16.85	73.40	20.63

Results at 13° (B.).

Sp. Gr. of Solutions.	Gms. per 100 cc. Solution. C_2H_5OH.	H_2O.	NaCl.
1.2030	0	88.70	31.60
1.1348	11.81	78.41	23.26
1.1144	15.99	74.64	20.81
1.0970	19.39	71.45	18.86
1.0698	24.95	65.80	16.23
1.0295	32.33	57.96	12.66
0.9880	40.33	49.34	9.13
0.9445	49.28	38.54	5.93
0.9075	57.91	29.37	3.47
0.8700	63.86	21.62	1.52
0.8400	72.26	11.24	0.50

Results at 30° and at 40° (T.).

Wt per cent Alcohol in Solvent	At 30°, Gms NaCl per 100 Gms. Solution.	Water.	At 40°, Gms NaCl per 100 Gms. Solution.	Water.
0	26.50	36.05	26.68	36.38
5	24.59	34.29	24.79	34.69
10	22.66	32.57	22.90	33.00
20	19.05	29.40	19.46	30.20
30	15.67	26.53	16.02	27.25
40	12.45	23.70	12.75	24.37
50	9.34	20.60	9.67	21.42
60	6.36	16.96	6.65	17.82
70	3.36	12.75	3.87	13.10
80	1.56	7.95	1.69	8.68
90	0.43	4.30	0.50	5.10

100 gms. alcohol of 0.9282 Sp. Gr. = 45.0% by wt. dissolve at:

4°	10°	13°	23°	32°	33°	44°	51°	60°	
10.9	11.1	11.43	11.9	12.3	12.5	13.1	13.8	14.1	gms. NaCl

(Gerardin — Ann. chim. phys. [4] 5, 146, '56.)

100 gms. of a mixture of equal parts of 96% alcohol and 98% ether dissolve 0.11 gm. NaCl.

(Mayer — Liebig's Ann. 98, 205, '56.)

Solubility of Sodium Chloride in Aqueous Methyl Alcohol.

(Armstrong and Eyre, 1910–11.)

Results at 0°.		Results at 25°.	
Solvent, Gms. CH_3OH per 1000 Gms. H_2O.	Gms. NaCl per 100 Gms. Sat. Sol.	Solvent, Gms. CH_3OH per 1000 Gms. H_2O.	Gms. NaCl per 100 Gms. Sat. Sol.
0	26.35	8.01	26.29
8.01	26.05	16.02	26.02
16.02	25.79	32.04	25.50
32.04	29.19	96.12	23.50

A sat. solution of NaCl in CH_3OH contains 0.1 gm. NaCl per 100 gms. solution at the critical temperature. (Centnerszwer, 1910.)

Solubility of Sodium Chloride in Aqueous Propyl Alcohol.

(Armstrong and Eyre, 1910–11.)

Aqueous propyl alcohol containing 15.01 gms. C_3H_7OH per 1000 cc. H_2O dissolves 25.71 gms. NaCl per 100 gms. sat. solution at 0° and 25.95 gms. at 25°.

Aqueous propyl alcohol containing 30.02 gms. C_3H_7OH per 1000 cc. H_2O dissolves 25.12 gms. NaCl per 100 gms. sat. solution at 0° and 25.37 gms. at 25°.

Equilibrium in the System Sodium Chloride, Normal Propyl Alcohol and Water at 23–25°.

(Frankforter and Frary, 1913)

The authors determined the binodal curve and quadruple points of the system but did not locate tie lines.

Gms. per 100 Gms. Homogeneous Liquid.			Gms per 100 Gms. Homogeneous Liquid.		
NaCl.	C_3H_7OH.	H_2O.	NaCl	C_3H_7OH.	H_2O.
0.55	87.7	11.75*	14.38	5.39	80.23
2.23	51 57	46.20	15.42	5.11	79.47
3.55	18.99	77 46	16 38	4.47	79.14
3.90	14 78	81.32	18.08	3.83	78.09
5.27	12.77	81 96	20 12	3.27	76.61
8.04	9.49	82.47	22.35	2.64	75.01
10.49	7.79	81.72	24.50	2 13	73.37
12.20	6.57	81.23	24.9	2.3	72.8*

* Quad. pt

The effect of temperature upon the equilibrium in the above system was greater than observed in any of the other systems investigated and additional data, illustrating the extent of the temperature influence, are given.

100 gms. sat. sol. of NaCl in 99.6 per cent C_3H_7OH contain 0.04 gm. NaCl at 25°. (Frankforter and Frary, 1913.)

Equilibrium in the Systems Sodium Chloride, Allyl Alcohol, Water, at 20° and Sodium Carbonate, Allyl Alcohol, Water, at 20°.

(Frankforter and Temple, 1915)

Results for $NaCl + CH_2:CHCH_2OH + H_2O$. Gms. per 100 Gms. Alcohol + Water.			Results for $Na_2CO_3 + CH_2:CH.CH_2OH + H_2O$. Gms. per 100 Gms. Alcohol + Water.		
NaCl.	Alcohol.	Water.	Na_2CO_3.	Alcohol.	Water.
3.509	69.867	30.133	0.456	61.112	38.888
4.452	64.858	33.142	0.708	56.334	43.666
5.079	60.821	39.179	1.011	51.930	48.070
6.712	54.683	45.317	1.468	48.109	51.891
8.776	47.132	52.868	2.580	41.052	58.948
10.650	40.392	59.608	3.414	37.126	62.874
12.535	33.224	66.776	4.739	32.166	67.834
14.925	27.261	72.739	7.774	23.753	76.247
18.557	19.705	80.295	10.079	18.407	81.593

SOLUBILITY OF SODIUM CHLORIDE IN SEVERAL ALCOHOLS AT 25°.

(Turner and Bissett, 1913.)

Alcohol.		Gms. NaCl per 100 Gms. Alcohol.
Methyl Alcohol,	CH_3OH	1.31
Ethyl Alcohol,	C_2H_5OH	0.065
Propyl Alcohol,	C_3H_7OH	0.012
Amyl Alcohol,	$C_5H_{11}OH$	0.002

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS ACETONE SOLUTIONS AT 20°

(Frankforter and Cohen, 1914.)

Gms. per 100 Gms. Sat. Sol.			Gms. per 100 Gms. Sat. Sol.		
NaCl.	H_2O.	$(CH_3)_2CO$.	NaCl.	H_2O.	$(CH_3)_2CO$.
25.9	73.06	1.04	16.55	61.59	21.86*
24.19	71.18	4.03	0.45	13.75	85.8*
20.85	66.78	12.37	0.32	13.92	85.76
18.32	63.16	18.52	0.19	10.82	88.99
17.89	62.21	19.90	0.12	8.94	90.94

* Quad pt.

Between the concentration 21.86 and 85.8 per cent acetone, two layers are formed. The binodal curve corresponding to this range of concentration was determined and it is stated by the authors that tie lines were located but the analytical data for them are not given. The results for the binodal curve are as follows:

Gms. per 100 Gms. Homogeneous Liquid.			Gms. per 100 Gms. Homogeneous Liquid.		
NaCl.	H_2O.	$(CH_3)_2CO$.	NaCl.	H_2O.	$(CH_3)_2CO$.
0.59	15.46	83.95	5.87	40.19	53.94
0.79	17.58	81.63	6.45	42.12	51.43
0.93	18.83	80.24	7.53	46.12	46.35
1.27	22.19	76.54	8.87	49.39	41.74
1.57	23.89	74.54	9.47	50.92	39.61
2.31	27.27	70.42	10.35	53.06	36.59
4.87	36.79	58.34	15.87	59.71	24.42

Additional data, showing the effect of temperature on the above system, are also given

SOLUBILITY OF SODIUM CHLORIDE IN AQUEOUS SOLUTIONS OF:

Acetone at 20°. (Herz and Knoch, 1904.) — Glycerol at 25°. (Herz and Knoch, 1905.)

cc. Acetone per 100 cc. Solvent.	NaCl per 100 cc. Solution. Millimols.	NaCl per 100 cc. Solution. Gms.	Wt. Per cent Glycerol in Solvent.	NaCl per 100 cc. Solution. Millimols.	NaCl per 100 cc. Solution. Gms.	Sp. Gr. of Solution.
0	537.9	31.47	0	545.6	31.93	1.1960
10	464.6	27.18	13.28	501.1	29.31	1.2048
20	394.8	23.10	25.98	448.4	26.23	1.2133
30	330.1	19.32	45.36	370.2	21.66	1.2283
32 Lower layer	308.5	18.05	54.23	333.9	19.54	1.2381
87 Upper layer	7.7	0.45	83.84	220.8	12.91	1.2666
88	7.3	0.43	100 *	167.1	9.78	1.2964
90	4.3	0.25				

* Sp. Gr. of Glycerol, 1.2592. Impurities about 1.5%.

100 gms. sat. solution in glycol contain 31.7 gms. NaCl at 14.8°. (de Coninck, 1905.)

100 gms. H_2O dissolve 236.3 gms. sugar + 42.3 gms. NaCl at 31.25°, or 100 gms. sat. aq. solution contain 62.17 gms. sugar + 11.13 gms. NaCl. (Köhler, 1897.)

Equilibrium in the System Sodium Chloride, Methyl Ethyl Ketone and Water at 25° (Binodal Curve).

(Frankforter and Cohen, 1916.)

Gms. per 100 Gms. Homogeneous Liquid.			Gms. per 100 Gms. Homogeneous Liquid.		
NaCl.	$CH_3.CO.C_2H_5$.	H_2O.	NaCl.	$CH_3.CO.C_2H_5$.	H_2O.
0.35	20.13	79.52	6.75	10.80	82.45
0.55	19.75	79.70	10.07	7.65	82.28
1.42	16.52	82.06	14.32	5.36	80.32
1.80	17.70	80.50	14.65	3.83	81.52
2.47	16.24	81.29	23.15	2.08	74.77
4.11	13.34	82.55	24.14	0.94	74.92

Solubility of Sodium Chloride in Aqueous Solutions of Carbamide (Urea) and of Formamide at 25°.

(Ritzel, 1911.)

In Aqueous Carbamide.		In Aqueous Formamide.	
Gms. $CO(NH_2)_2$ per 100 cc. Solution.	Gms NaCl per 100 cc. Solution.	Gms. $HCO.NH_2$ per 100 cc Solution.	Gms NaCl per 100 cc. Solution.
0	31.80	0	31.80
5	30.63	2.3	30.98
9.6	29.05	5.3	30.86
13	28.46	8	30.40
18	27.65	11	29.11
23	27.24	15	28.52
28	26.56	18.8	27.76

According to results by Fastert (1912), the solubility of sodium chloride in aqueous solutions of urea increases slightly with increase of urea in solution, thus:

Gms. $CO(NH_2)_2$ per 100 cc. Sol.	10	20	30	40	50
Gms. NaCl per 100 cc. Sol.	31.92	32.17	32.51	32.93	33.40

Data for equilibrium in the system sodium chloride, succinic acid nitrile, water are given by Timmermans (1907).

100 gms. 95% formic acid dissolve 5.8 gms. NaCl at 19.7°. (Aschan, 1913.)
100 gms. hydroxylamine dissolve 14.7 gms. NaCl at 17.5°. (de Bruyn, 1892.)
100 cc. anhydrous hydrazine dissolve 8 gms. NaCl at room temp. (Welsh and Broderson, 1915.)

Fusion-Point Data (Solubilities, see footnote, p. 1) Are Given for the Following Mixtures.

NaCl + HCl. (Dernby, 1918.)
" + Na_2CrO_4. (Sackur, 1911–12.)
" + NaCN. (Truthe, 1912.)
" + NaF. (Ruff and Plato, 1903; Wolters, 1910; Plato, 1907.)
" + NaOH. (Scarpa, 1915.)
" + NaI. (Ruff and Plato, 1903; Amadori, 1912a.)
" + $NaNO_3$. (Meneghini, 1912.)
" + $Na_4P_2O_7$. (LeChatelier, 1894.)
" + Na_2SO_4. (Ruff and Plato, 1903; Jänecke, 1908; Wolters, 1910; Sackur, 1911–12.)
" + $SrCl_2$. (Vortisch, 1914; Sackur, 1911–12.)
" + $SrCO_3$. (Sackur, 1911–12.)
" + TlCl. (Sandonnini, 1911, 1914.)

SODIUM CHROMATES (Mono, Di, etc.)

SOLUBILITY IN WATER.

(Mylius and Funk, 1900; see also Salkowski, 1901.)

Sodium Monochromate.

t°.	Gms. Na_2CrO_4 per 100 Gms. Solution.	Mols. Na_2CrO_4 per 100 Mols H_2O.	Solid Phase.
0	24.07	3.52	$Na_2CrO_4.10H_2O$
10	33.41	5.55	"
18*	40.10	7.43	"
18.5	41.65	7.94	"
19.5	44.78	9.01	"
21	47.40	10.00	"
25.6	46.08	9.52	$Na_2CrO_4.4H_2O$
31.5	47.05	9.90	"
36	47.98	10.2	"
40	48.97	10.6	"
45	50.20	11.6	"
49.5	50.93	11.5	"
54.5	52.28	12.2	"
59.5	53.39	12.7	"
65	55.23	13.7	Na_2CrO_4
70	55.15	13.6	"
80	55.53	13.8	"
100	55.74	14.0	"

Sodium Dichromate.

t°.	Gms. $Na_2Cr_2O_7$ per 100 Gms. Solution.	Mols. $Na_2Cr_2O_7$ per 100 Mols. H_2O.	Solid Phase.
0	61.98	11.2	$Na_2Cr_2O_7.2H_2O$
17	63.82	12.1	"
18‡	63 92	12.16	"
34.5	67.36	14.2	"
52	71.76	17.4	"
72	76.9	22.8	"
81	79.8	27.1	"
93	81.19	29.6	$Na_2Cr_2O_7$
98	81.25	29.8	"

Sodium Tri Chromate.

t°.	Gms $Na_2Cr_3O_{10}$ per 100 Gms. Solution.	Mols $Na_2Cr_3O_{10}$ per 100 Mols. H_2O	Solid Phase.
0	80.03	19.9	$Na_2Cr_3O_{10}.H_2O$.
15†	80.44	20.4	"
18	80.60	20.56	"
55	82.68	23.7	"
99	85.78	29.9	"

* Sp. Gr. of sat. sol. at 18° = 1.432. † Sp. Gr. of sat. sol. at 18° = 2.059
‡ Sp. Gr. of sat. solution at 18° = 1 745.

Sodium Tetrachromate.

t°.	Gms. $Na_2Cr_4O_{13}$ per 100 Gms. Solution.	Mols. $Na_2Cr_4O_{13}$ per 100 Mols. H_2O.	Solid Phase.
0	72.96	10.5	$Na_2Cr_4O_{13}.4H_2O$
16	74.19	11.2	"
18*	74.60	11.27	"
22	76.01	12.3	"

* Sp. Gr. of sat. solution at 18° = 1.926.

Tetrasodium Chromate.

t°.	Gms. Na_4CrO_5 per 100 Gms. Solution.	Mols. Na_4CrO_5 per 100 Mols. H_2O.	Solid Phase.
0	33.87	4.11	$Na_4CrO_5.13HO_2$
10	35.58	4.42	"
18†	37.50	4.81	"
27.7	40.09	5.38	"
37	45.13	6.62	"

† Sp. Gr. of sat. solution at 18° = 1.446.

A new hydrate of sodium chromate, $Na_2CrO_4.6H_2O$, was found by Salkowski, (1901) and the following data for its range of existence were determined.

t°.	Gms. Na_2CrO_4 per 100 Gms. Solution.	Mols. Na_2CrO_4 per 100 Mols. H_2O.	Solid Phase.
17.7	43.65	8.62	$Na_2CrO_4.10H_2O$
19.2	44.12	8.77	"
19.525	44.2*	...	" $+Na_2CrO_4.6H_2O$
21.2	44.64	8.96	$Na_2CrO_4.6H_2O$
24.7	45.75	9.37	"
25.9	46.3*	9.57	$Na_2CrO_4.6H_2O$ $+Na_2CrO_4.4H_2O$
28.9	46.47	9.64	$Na_2CrO_4.4H_2O$
29.7	46.54	9.67	"
31.2	47.08	9.88	"

* This determination by Richards and Kelley (1911).

SOLUBILITY OF SODIUM CHROMATES IN WATER AT 30°.

(Schreinemakers, 1906.)

Composition in weight per cent:

Of Solution.		Of Residue.		
% CrO_3.	% Na_2O.	% CrO_3.	% Na_2O.	Solid Phase.
0	±42	...	...	$NaOH.H_2O$
2.00	41.44	5.83	42.64	$NaOH.H_2O + Na_2CrO_4$
2.04	40.89	...	...	Na_2CrO_4
4.23	35.51	27.52	36.57	"
6.64	32.34	27.72	34.60	"
15.19	27.06	37.07	32.20	"
10.22	29.39	15.48	28.41	$Na_2CrO_4 + Na_4CrO_5.13H_2O$
8.93	28.49	18.09	26.89	$Na_4CrO_5.13H_2O$
8.62	26.91	...	...	"
13.12	23.91	18.57	25.92	"
18.44	22.86	...	...	"
19.26	22.98	21.54	25.31	$Na_4CrO_5.13H_2O + Na_2CrO_4.4H_2O$
17.84	24.21	26.24	24.98	$Na_2CrO_4.4H_2O$
28.82	17.88	31.97	23.47	"
38.93	16.30	40.70	20.83	"
48.70	16.49	47.49	19.75	$Na_2CrO_4.4H_2O + Na_2Cr_2O_7.2H_2O$
50.68	15.72	...	...	$Na_2Cr_2O_7.2H_2O$
58.08	13.89	62.76	17.38	"
66.13	13.70	69.48	16.06	$Na_2Cr_2O_7.2H_2O + Na_2Cr_3O_{10}.H_2O$
65.98	14.15	69.46	15.15	$Na_2Cr_3O_{10}.H_2O$
68.46	10.95	73.88	13.38	$Na_2Cr_3O_{10}.H_2O + Na_2Cr_4O_{13}.4H_2O$
66.88	9.85	71.27	10.67	$Na_2Cr_3O_{13}.4H_2O$
70.06	11.85	83.95	9.57	" (?)
69.04	11.04	81.80	6.43	CrO_3
67.84	9.81	82.85	5.42	"
64.48	4.51	79.49	2.71	"
62.28	0.0		...	"

100 gms. of a saturated aqueous solution contain at 30°:
46.627 gms. Na_2CrO_4, or 100 gms. H_2O dissolve 87.36 gms. Na_2CrO_4.
66.4 gms. $Na_2Cr_2O_7$, or 100 gms. H_2O dissolve 197.6 gms. $Na_2Cr_2O_7$.
100 gms. absolute methyl alcohol dissolve 0.345 gms. Na_2CrO_4 at 25°.

(de Bruyn, 1892.)

Data for equilibrium in the system sodium chromate, sodium sulfate and water at 15° and at 25° are given by Takenchi (1915). The mixtures were rotated at constant temperature until attainment of equilibrium and both the saturated solutions and the undissolved residues were analyzed. Very extensive tables of results are given. The decahydrates of sodium and chromium are isomorphous and the results show that these two salts are mutually miscible in all proportions at 15°. At 25° the solubility curve consists of three branches. The solutions of the first branch are in equilibrium with decahydrated mixed crystals, those of the second branch with anhydrous sulfate and those of the third with both anhydrous sodium sulfate and hexahydrated sodium chromate.

SOLUBILITY OF SODIUM DICHROMATE IN ALCOHOL AT 19.4°.
(Reinitzer, 1913.)

An excess of $Na_2Cr_2O_7.2H_2O$ was shaken with absolute alcohol for 10 minutes and the mixture filtered. The filtrate contained 5.132 gms. $Na_2Cr_2O_7.2H_2O$ per 100 cc. and its $d_{19.4}$ was 0.8374. The solution decomposed within a few minutes with production of a brown precipitate and evolution of an aldehyde odor. The results are, therefore, only approximately correct.

SODIUM CINNAMATE $C_6H_5CH:CHCOONa$.

100 gms. H_2O dissolve 9.1 gms. sodium cinnamate at 15.20°.
100 cc. 90% alcohol dissolve 0.625 gm. at 15–20°. (Squire and Caines, 1905.)

SODIUM CITRATE $(CH_2)_2COH(COONa)_3.5\frac{1}{2}H_2O$.

SOLUBILITY IN AQUEOUS ETHYL ALCOHOL AT 25°.
(Seidell, 1910.)

Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_6H_5O_7Na_3.5\frac{1}{2}H_2O$ per 100 Gms. Sat. Sol.	Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms $C_6H_5O_7Na_3.5\frac{1}{2}H_2O$ per 100 Gms. Sat. Sol.
0	1.276	48.1	40	0.953	4.5
10	1.190	37.4	50	0.918	1.4
20	1.100	25	60	0.892	0.3
30	1.006	11.8	100	0.789	0

Data for equilibrium in the system sodium hydroxide, citric acid, phosphoric acid and water at 20° are given by Pratolongo (1913).
The author fails to describe clearly the terms in which the results are expressed, consequently their exact meaning is not clear.

SODIUM (Ferro) CYANIDE $Na_4Fe(CN)_6$.

SOLUBILITY IN WATER.
(Conroy, 1898.)

t°.	20°.	42°.	80°.	98.5°.
Gms. $Na_4Fe(CN)_6$ per 100 gms. H_2O	17.9	30.2	59.2	63

SODIUM FLUORIDE NaF.

100 gms. sat. aq. solution contain 4.3 gms. NaF at 18°. Sp. Gr. of solution = 1.044. (Mylius and Funk, 1897.)

SOLUBILITY OF SODIUM FLUORIDE IN AQUEOUS SOLUTIONS OF HYDROFLUORIC ACID AT 21°.
(Ditte, 1896.)

Gms. per 1000 Gms. H_2O.		Gms. per 1000 Gms. H_2O.	
0 HF	41.7 NaF	83.8 HF	22.9 NaF
10 "	41.4 "	129.7 "	23.8 "
45.8 "	22.5 "	596.4 "	48.8 "
56.5 "	22.7 "	777.4 "	81.7 "

FUSION-POINT DATA (Solubility, see footnote, p. 1) ARE GIVEN FOR THE FOLLOWING MIXTURES.

NaF + FeF_3.	(Puschin and Baskov, 1913.)
" + ZnF_2.	" "
" + NaI.	(Ruff and Plato, 1903.)
" + NaOH.	(Scarpa, 1915.)
" + Na_2SO_4.	(Wolters, 1910.)

SODIUM FLUOSILICATE Na_2SiF_6.

100 gms. H_2O dissolve 0.65 gm. at 17.5°, and 2.45 gms. at 100°. (Stolba, 1872.)

SODIUM FORMATE HCOONa.

SOLUBILITY IN WATER.

(Groschuff, 1903.)

t°.	Gms. HCOONa per 100 Gms Solution.	Mols. HCOONa per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. HCOONa per 100 Gms. Solution.	Mols. HCOONa per 100 Mols. H_2O.	Solid Phase.
−20	22.80	7.82	$HCOONa.3H_2O$	25.5	50.53	27.0	$HCOONa.2H_2O$
0	30.47	11.6	"	18	49.22	25.65	HCOONa
+15	41.88	19.1	"	29	50.44	26.9	"
18	44.92	21.6	"	54	53.80	30.8	"
18	44.73	21.4	$HCOONa.2H_2O$	74.5	56.82	34.8	"
21	46.86	23.3	"	100.5	61.54	42.35	"
23	48.22	24.65	"	123	66.20	51.8	"

Sp. Gr. of the saturated solution of the dihydrate at 18° = 1.317.

SOLUBILITY OF SODIUM ACID FORMATE (EXPRESSED AS NEUTRAL SALT) IN AQUEOUS SOLUTIONS OF FORMIC ACID.

(Groschuff.)

t°.	Gms. HCOONa per 100 Gms. Solution.	Mols. HCOONa per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. HCOONa per 100 Gms. Solution.	Mols. HCOONa per 100 Mols. H_2O.	Solid Phase.
0	22.35	19.5	HCOONa.HCOOH	45.5	38.85	43.1	HCOONa
25.5	29.62	28.45	"	70	41.27	47.5	"
66.5	41.08	47.1	"	85	43.09	51.2	

SODIUM GLYCEROPHOSPHATE (Disodium) $OP(OC_3H_7O_2)(ONa)_2.5H_2O$.

100 gms. sat. solution in H_2O contain 27.38 gms. of the anhydrous salt at 18°.

(Rogier and Fiore, 1913.)

SODIUM HYDROXIDE NaOH.

SOLUBILITY IN WATER.

(Pickering, 1893; Mylius and Funk (Dietz), 1900)

t°.	Gms. NaOH per 100 Gms. Solution.	Gms. NaOH per 100 Gms. Water.	Solid Phase.	t°.	Gms. NaOH per 100 Gms. Solution.	Gms. NaOH per 100 Gms. Water.	Solid Phase.
− 7.8	8.0	8.7	Ice	20	52.2	109	$NaOH.H_2O$
−20	16.0	19.1	"	30	54.3	119	"
−28	19.0	23.5	Ice + $NaOH.7H_2O$	40	56.3	129	"
−24	22.2	28.5	$NaOH.7H_2O + NaOH.5H_2O$	50	59.2	145	"
−17.7	24.5	32.5	$NaOH.5H_2O + NaOH.4H_2O\ \alpha$	60	63.5	174	"
0	29.6	42.0	$NaOH.4H_2O\ \alpha$	64.3	69.0	222.3	" f. pt.
+ 5	32.2	47.5	$NaOH.4H_2O\ \alpha + NaOH.3\frac{1}{2}H_2O$	61.8	74.2	288	$NaOH.H_2O$ + NaOH
10	34.0	51.5	$NaOH.3\frac{1}{2}H_2O$	80	75.8	313	NaOH (?)
15.5	38.9	63.53	" f. pt.	110	78.5	365	"
5	45.5	83.5	$NaOH.3\frac{1}{2}H_2O + NaOH.2H_2O$	192	83.9	521	"
12	50.7	103.0	$NaOH.2H_2O + NaOH.H_2O$				

Sp. Gr. of sat. solution at 18° = 1.539.

For determinations of the Sp. Gr. of sodium hydroxide solution, see Kohlrausch, 1879; Wegscheider and Walter, 1905.

100 gms. of the sat. solution in water contain 46.36 gms. NaOH at 15°.

(de Forcrand, 1909a.)

1000 gms. liquid ammonia dissolve 0.0025 gm. NaOH at −40°.

(Skossarewsky and Tchitchinadze, 1916.)

Data for equilibrium in the system sodium hydroxide, resorcinol and water at 30° are given by van Meurs (1916).

Fusion-point data for NaOH + NaI are given by Scarpa (1915).

SODIUM IODATE $NaIO_3$.

SOLUBILITY IN WATER. (Gay-Lussac; Kremers, 1856a.)

t°.	0°.	20°.	40°.	60°.	80°.	100°.
Gms. $NaIO_3$ per 100 gms. H_2O	2.5	9	15	21	27	34

EQUILIBRIUM IN THE SYSTEM SODIUM IODATE, IODIC ACID AND WATER AT 30°.

(Meerburg, 1905.)

Gms. per 100 Gms. Sat. Sol. HIO_3.	$NaIO_3$.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. HIO_3.	$NaIO_3$.	Solid Phase.
0	9.36	$NaIO_3.1\frac{1}{2}H_2O$	11.20	7.54	$Na_2O.2I_2O_5$
1.98	9.52	"	11.82	7.20	" $+NaIO_3.2HIO_3$
4.86	10.22	"	11.62	5.65	$NaIO_3.2HIO_3$
5.86	11.04	"	23.23	3.69	"
7.40	11.60	" unstable	32.68	2.91	"
9.73	14.73	" "	46.62	2.67	"
6.70	11.21	" $+Na_2O.2I_2O_5$	55.48	2.12	"
7.80	10.30	$Na_2O.2I_2O_5$	65.47	1.83	"
9.15	9	"	76.19	1.42	" $+HIO_3$
9.93	8.71	"	76.70	0	HIO_3

SODIUM IODIDE $NaI.2H_2O$.

SOLUBILITY IN WATER.

(de Coppet, 1883; see also Etard, 1884; and Kremers, 1856a.)

t°.	Grams NaI per 100 Gms. Water.	Solution.	Solid Phase.	t°.	Grams NaI per 100 Gms. Water.	Solution.	Solid Phase.
−20	148.0	59.7	$NaI.2H_2O$	60	256.8	72.0	$NaI.2H_2O$
0	158.7	61.4	"	65	278.4	73.6	"
10	168.6	62.8	"	67	293	74.6	NaI
20	178.7	64.1	"	70	294	74.6	"
25	184.2	64.8	"	80	296	74.7	"
30	190.3	65.6	"	100	302	75.1	"
40	205.0	67.2	"	120	310	75.6	"
50	227.8	69.5	"	140	321	76.3	"

The eutectic mixture of Ice + $NaI.5H_2O$ is at −31.5° and contains about 39 per cent NaI. (Meyerhoffer, 1904.)

The tr. pt. for $NaI.5H_2O$ + $NaI.2H_2O$ is at −13.5 and the saturated solution contains 60.2 gms. NaI per 100 gms. (Panfiloff, 1893a.)

The tr. pt. for $NaI.2H_2O$ + NaI is at 64.3° and the saturated solution contains 74.4 gms. NaI per 100 gms. (Panfiloff, 1893.)

100 gms. H_2O dissolve 172.4 gms. NaI at 15° and the d_{15} of the sol. is 1.8937. (Greenish, 1900.)

100 gms. sat. solution in H_2O contain 65.5 gms. NaI at 30°. (Cocheret, 1911.)

SOLUBILITY OF SODIUM IODIDE IN ALCOHOLS AT 25°.

(Turner and Bissett, 1913.)

100 gms.	Methyl alcohol,	CH_3OH	dissolve	90.35	gms. NaI.
"	Ethyl "	C_2H_5OH	"	46.02	"
"	Propyl "	C_3H_7OH	"	28.22	"
"	Amyl "	$C_5H_{11}OH$	"	16.30	"

Solubility of Sodium Iodide in Aqueous Ethyl Alcohol at 30°.

(Cocheret, 1911.)

Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
NaI.	C_2H_5OH.		NaI.	C_2H_5OH.	
65.52	0	$NaI.2H_2O$	38.5	53.2	$NaI.2H_2O$
64	3.42	"	37.49	55.37	" + NaI
54.2	18.5	"	35.65	59.24	NaI
48.8	28.5	"	33.24	61.78	"
42.35	41.7	"	30.90	68.70	"

Data are also given for the solubility of mixtures of NaI + Na_2CO_3 in aqueous ethyl alcohol at 30°.

Solubility of Sodium Iodide in Absolute Ethyl Alcohol at Temperatures up to the Critical Point.

(Tyrer, 1910a.)

t°.	Gms. NaI per 100 Gms. C_2H_5OH	t°.	Gms. NaI per 100 Gms. C_2H_5OH.	t°.	Gms. NaI per 100 Gms. C_2H_5OH.
10	43.77	120	45.2	240	32.7
30	44.25	160	45	250	26.2
50	44.50	180	44.3	255	21
80	45	200	42.3	260	10.8
100	45.1	220	38.5	261.5*	8.6
		230	36.2		

* crit. t. of solution.

The mixtures were placed in sealed glass tubes which were heated in a specially constructed, electrically heated air bath. The temperature at which the last trace of salt just dissolved was determined in each case. The experiments were made with very great care. Results are also given for the solubility of sodium iodide in the vapor of ethyl alcohol above the critical point.

Solubility of Sodium Iodide in Mixtures of Alcohols at 25°.

(Herz and Kuhn, 1908.)

In $CH_3OH + C_2H_5OH$.			In $CH_3OH + C_3H_7OH$.			In $C_2H_5OH + C_3H_7OH$.		
Per cent CH_3OH in Mixture.	d_{25} of Sat. Sol.	Gms. NaI per 100 cc. Sat. Sol.	Per cent C_3H_7OH in Mixture.	d_{25} of Sat. Sol.	Gms. NaI per 100 cc. Sat. Sol.	Per cent C_3H_7OH in Mixture.	d_{25} of Sat. Sol.	Gms. NaI per 100 cc. Sat. Sol.
0	1.0806	35.15	0	1.3250	63.22	0	1.0806	35.15
4.37	1.1029	37.68	11.11	1.2853	58.45	8.1	1.0732	34.60
10.4	1.1123	38.71	23.8	1.2528	54.64	17.85	1.0720	34.05
41.02	1.1742	45.98	65.2	1.1387	40.71	56.6	1.0276	28.41
80.69	1.2741	57.44	91.8	1.0420	29.14	88.6	1.0130	26.13
84.77	1.2886	58.92	93.75	1.0178	26.49	91.2	1.0104	25.88
91.25	1.3056	61.10	100	0.9968	24.11	95.2	1.0020	24.74
100	1.3250	63.22				100	0.9968	24.11

Solubility of Sodium Iodide in Several Solvents.

(At 22.5°, de Bruyn, 1892; at ord. temp. Rohland, 1898; Walden, 1906.)

Solvent.	t°.	Gms. NaI per 100 Gms. Solvent.
Absolute Ethyl Alcohol	22.5	43.1
Ethyl Alcohol, $d_{15} = 0.810$	ord. temp.	58.8
Absolute Methyl Alcohol	22.5	77.7
Methyl Alcohol, $d_{15} = 0.799$	ord. temp.	83.3
Propyl Alcohol, $d_{15} = 0.816$	ord. temp.	26.3

Solvent.	Gms. NaI per 100 cc. Sat. Solution. at 0°.	at 25°.
Acetonitrile	22.09	18.43
Propionitrile	9.09	6.23
Nitro Methane	0.34	0.48
Acetone	very soluble	
Furfural	...	25.10

SOLUBILITY OF SODIUM IODIDE IN ACETAMIDE.
(Menschutkin, 1908.)

t°.	Gms. per 100 Gms. Sat. Sol. $NaI.2CH_3CONH_2$	= NaI.	Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol. $NaI.2CH_3CONH_2$	= NaI.	Solid Phase.
82	m. pt. of pure acetamide		CH_3CONH_2	50	59	33	$NaI.2CH_3CONH_2$
78	9.5	5.32	"	60	60.5	33.9	"
74	18	10.08	"	70	62.2	34.8	"
70	25.5	14	"	80	64.2	35.9	"
66	31.9	17.86	"	90	66.5	37.2	"
62	37.3	20.9	"	100	69.2	38.7	"
58	41.9	23.44	"	110	72.6	40.6	"
54	46.1	25.8	"	120	78.7	44	"
50	50	28	"	125	84.7	47.4	" +NaI
46	53.7	30.1	"	150	85.1	47.7	NaI
41.5	57.7	32.3	" $+NaI.2CH_3CONH_2$	175	85.5	47.9	"

100 cc. anhydrous hydrazine dissolve 64 gms. NaI at room temp. (Welsh and Broderson, 1915.)

SODIUM IODOMERCURATE

A saturated solution at 24.75°, prepared by adding NaI and HgI_2 in excess to water, contained 4.59% Na, 25% Hg, 58.25% I and 12.2% H_2O, corresponding to 0.20 mol. alkali, 0.12 mol. Hg and 0.45 mol. I. (Duboin, 1905.)

SODIUM MOLYBDATE Na_2MoO_4.

SOLUBILITY IN WATER.
(Funk, 1900a)

t°.	Gms. Na_2MoO_4 per 100 Gms. Solution.	Mols. Na_2MoO_4 per 100 Mols H_2O.	Solid Phase.	t°.	Gms. Na_2MoO_4 per 100 Gms. Solution.	Mols. Na_2MoO_4 per 100 Mols. H_2O.	Solid Phase.
0	30.63	3.86	$Na_2MoO_4.10H_2O$	15.5	39.27	5.65	$Na_2MoO_4.2H_2O$
4	33.83	4.47	"	18	39.40	5.70	"
6	35.58	4.83	"	32	39.82	5.78	"
9	38.16	5.39	"	51.5	41.27	6.14	"
10	39.28	5.65	$Na_2MoO_4.2H_2O$	100	45.57	7.32	"

d of the sat. sol. at 18° is 1.437.

100 gms. H_2O dissolve 3.878 gms. sodium trimolybdate, $Na_2Mo_3O_{10}$, at 20°, and 13.7 gms. at 100°. (Ullik, 1867.)

100 cc. H_2O dissolve 28.39 gms. $Na_2O.4MoO_3.6H_2O$ at 21°, d_{25} = 1.47. (Wempe, 1912.)

Fusion-point data for $Na_2MoO_4 + Na_2WO_4$ and $Na_2MoO_4 + Na_2SO_4$ are given by Boeke (1907).

SODIUM NITRATE $NaNO_3$.

SOLUBILITY IN WATER.
(Mulder; Berkeley, 1904; see also Ditte, 1875; Maumee, 1864; Etard, 1894.)

t°.	Gms. $NaNO_3$ per 100 Gms. Solution.	Gms. $NaNO_3$ per 100 Gms. Water.	Mols. per Liter.	t°.	Gms. $NaNO_3$ per 100 Gms. Solution.	Gms. $NaNO_3$ per 100 Gms. Water.	Mols. per Liter.
0	42.2	72.9– 73 *	6.71*	80	59.7	148 –148. *	10.35
10	44.7	80.8– 80.5	7.16	100	64.3	180 –175.8	11.30
20	46.7	87.5– 88	7.60	120	68.6	218 –208.8†	12.22
25	47.6	91 – 92	7.80	180	78.1	356.7	
30	48.7	94.9– 96.2	8.06	220	83.5	506	
40	50.5	102 –104.9	8.51	225	91.5	1076	
50	52.8	112 –114	8.97	313‡	100	∞	
60	54.9	122 –124	9.42	...			

* Berkeley. † at 119°. ‡ m.pt.

Solubility of Sodium Nitrate in Aqueous Ammonia Solutions at 15°.

(Fedotieff and Koltunoff, 1914.)

In Aqueous NH_3.

d_{15} of Sat. Sol.	Gms. per 100 Gms. H_2O. NH_3.	$NaNO_3$.
1.253	13.87	75.03
1.233	17.28	73.99
1.212	20.38	73.18

In Aqueous $NH_3 + NH_4NO_3$.

d_{15} of Sat. Sol.	Gms. per 100 Gms. H_2O. NH_3.	NH_4NO_3.	$NaNO_3$.
1.324	12.91	83.51	74.10
1.330	16.97	128.9	69.40

Solubility of Sodium Nitrate in Aqueous Solutions of Nitric Acid at 0°.

(Engel, 1887; see also Schultz, 1860.)

Equivalents per 10 cc. Solution. $NaNO_3$.	HNO_3.	Sp. Gr. of Solutions.	Grams per 100 cc. Solution. $NaNO_3$.	HNO_3.
66.4	0	1.341	56.5	0.00
63.7	2.65	1.338	54.2	1.67
60.5	5.7	1.331	51.48	3.59
56.9	8.8	1.324	48.42	5.55
52.75	12.57	1.312	44.88	7.92
48.7	16 9	1.308	41.44	10.65
39.5	27 0	1.291	33.61	17.02
35.1*	32.25	1.285	29 86	20 33
31.1	37.25	1.282	26.46	23 48
23.5	48.0	1.276	20.0	30.26
18.0	57.25	1.276	15.32	36.09
12.9	71.0	1.291	10.97	44.76

Solubility of Mixtures of Sodium Nitrate and Potassium Nitrate in Water at 20°.

(Carnelly and Thomson, 1888.)

Per cent $NaNO_3$ in Mixtures Used.	Gms. per 100 Gms. H_2O $NaNO_3$.	KNO_3.	Per cent $NaNO_3$ in Mixtures Used.	Gms. per 100 Gms. H_2O $NaNO_3$.	KNO_3.
100	86.8	0	45.7	53.3	34.7
90	96.4	13.2	40	45.6	35.5
80	98.0	38.5	20	20.8	33.3
60	90.0	47.6	10	9.4	31.5
50	66.0	40.0	0	0 0	33.6

100 gms. H_2O dissolve 24.9 gms. NaCl + 53.6 gms. $NaNO_3$ at 20°.

(Rüdorff, 1873; Karsten; Nicol, 1891.)

Solubility of Sodium Nitrate in Aqueous Solutions of Sodium Hydroxide at 0°.

(Engel, 1891.)

Milligram Mols. per 10 cc. Solution. Na_2O.	$NaNO_3$.	Sp. Gr. of Solutions.	Grams per 100 cc. Solution. NaOH.	$NaNO_3$.
0.0	66.4	1.341	0.0	56.50
2.875	62.5	1.338	2.30	53.19
6.1	57.15	1.333	4.89	48.63
12.75	47.5	1.327	10.21	40 42
26.0	29.5	1.326	20.83	25.10
39.0	17.5	1.332	31.25	14.89
45.88	13.19	1.356	36.76	11.22
60.88	6.05	1.401	48.75	5.15

Data for equilibrium in the system sodium nitrate, sodium sulfate and water at 10°, 20°, 25°, 30°, 34° and 35° are given by Massink (1916, 1917).

Solubility of Sodium Nitrate in Aqueous Solutions of Sodium Thiosulfate.

(Kremann and Rodemund, 1914.)

Results at 9°.

Gms. per 100 Gms. Sat. Sol. $NaNO_3$.	$Na_2S_2O_3$.	Solid Phase.
33.31	12.26	$NaNO_3$
22.57	23.41	" $+Na_2S_2O_3.5H_2O$
4.22	34.77	$Na_2S_2O_3.5H_2O$

Results at 25°.

Gms. per 100 Gms. Sat. Sol. $NaNO_3$.	$Na_2S_2O_3$.	Solid Phase.
35.42	12.72	$NaNO_3$
25.40	24.25	"
19.90	31.81	" $+Na_2S_2O_3.5H_2O$
18.02	32.83	$Na_2S_2O_3.5H_2O$
4.33	40.50	"

Solubility of Sodium Nitrate in Alcohols.

100 gms. abs. methyl alcohol dissolve 0.41 gm. $NaNO_3$ at 25°.
100 gms. abs. ethyl alcohol dissolve 0.036 gm. $NaNO_3$ at 25°. (de Bruyn, 1892.)

Solubility of Sodium Nitrate in Aqueous Ethyl Alcohol at Different Temperatures.

(Bodländer, 1891; Taylor, 1897; Bathrick, 1896.)

Results at 13° (B.).

Sp. Gr. of Solutions.	Gms. per 100 cc. Solution. C_2H_5OH.	H_2O.	$NaNO_3$.
1.3700	0.0	75.34	61.66
1.3395	3.08	73.53	57.34
1.3120	6.01	71.81	53.39
1.2845	8.30	70.85	49.30
1.2580	10.91	69.47	45.42
1.2325	13.77	67.12	42.36
1.2010	16.46	66.16	37.48

Results at 16.5° (B.).

Sp. Gr. of Solutions.	Gms. per 100 cc. Solution. C_2H_5OH.	H_2O.	$NaNO_3$.
1.3745	0.0	75.25	62.20
1.3162	6.16	70.82	54.64
1.2576	11.60	68.10	46.06
1.2140	16.49	65.04	39.87
1.1615	22.17	61.67	32.31
1.0855	32.22	52.92	23.41
1.0558	37.23	48.50	19.85
1.0050	43.98	42.78	13.74
0.9420	52.60	32.13	9.47
0.9030	60.00	25.65	4.65
0.8610	63.16	21.31	1.63

Results at 30° (T.).

Wt. per cent Alcohol in Solvent.	Gms. $NaNO_3$ per 100 Gms. Solution.	Water.
0	49.10	96.45
5	46.41	91.15
10	43.50	85.55
20	37.42	74.75
30	31.31	65.10
40	25.14	55.95
50	18.94	46.75
60	12.97	37.25
70	7.81	28.25
90	1.21	12.25

Results at 40° (Bathrick).

Wt. per cent Alcohol	Gms. $NaNO_3$ per 100 Gms. Aq. Alcohol.
0	104.5
8.22	90.8
17.4	73.3
26.0	61.6
36.0	48.4
42.8	40.6
55.3	27.1
65.1	18.1
77.0	9.4
87.2	4.2

Solubility of Sodium Nitrate in Aqueous Alcohol at 25°.

(Armstrong and Eyre, 1910–11.)

Solvent. Mols. C_2H_5OH per 1000 Gms. H_2O.	= Gms. C_2H_5OH per 1000 Gms. H_2O.	Gms. $NaNO_3$ per 100 Gms. Sat. Sol.
0	0	47.93
0.25	11.51	47.32
0.50	23.03	46.73
1	46.06	45.43
2	92.12	43.04

Solubility of Sodium Nitrate in Aqueous Solutions of Acetone.

Results at 30°.
(Taylor, 1897.)

Wt. per cent Acetone in Solvent.	Gms. $NaNO_3$ per 100 Gms. Solution.	Gms. $NaNO_3$ per 100 Gms. Water.
0	49.10	96.45
5	46.96	93.20
9.09	45.11	90.40
20	40.10	83.70
30	35.08	77.20
40	29.80	70.75
50	24.34	64.40
60	18.55	59.95
70	13.15	50.50
80	7.10	38.20
90	1.98	20.20

Results at 40°.
(Bathrick, 1896.)

Wt. per cent Acetone.	Gms. $NaNO_3$ per 100 Gms. Aq. Acetone.
0.0	105
8.47	91.2
16.8	78.3
25.2	66.4
34.3	57.9
44.1	46.2
53.9	32.8
64.8	23.0
76.0	10.8
87.6	3.2

100 gms. hydroxylamine dissolve 13.1 gms. $NaNO_3$ at 17–18°. (de Bruyn, 1892.)
100 cc. anhydrous hydrazine dissolve 100 gms. $NaNO_3$ at room temp. (Welsh and Broderson, 1915.)

Fusion-point data for $NaNO_3 + NaNO_2$ are given by Bruni and Meneghini (1909, 1910).

Results for $NaNO_3 + SrNO_3 + KNO_3$ are given by Harkins and Clark (1915) and results for $NaNO_3 + TlNO_3$ by van Eyk (1905).

SODIUM NITRITE $NaNO_2$.

Solubility in Water.

(Oswald, 1912, 1914.)

t°.	Gms. $NaNO_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $NaNO_2$ per 100 Gms. Sat. Sol.	Solid Phase.
− 4.5	9.1	Ice	30	47.8	$NaNO_2$
− 9	23.8	"	40	49.6	"
−12.5	29.6	"	52.5	51.4	"
−15.5 Eutec.	39.7	" $+NaNO_2$	65	54.6	"
− 8	40.8	$NaNO_2$	81	57.9	"
0	41.9	"	92	59.7	"
10	43.8	"	103	62.6	"
20	45.8 (d = 1.3585)	"	128	68.7	"

100 gms. H_2O dissolve 83.3 gms. $NaNO_2$ at 15°. (Divers, 1899.)
100 gms. H_2O dissolve 83.25 gms. $NaNO_2$ at 15°. (v. Niementowski and v. Roszkowski, 1897.)
100 gms. H_2O dissolve 73.5 gms. $NaNO_2$ at 15°, d_{15} = 1.3476. (Greenish and Smith, 1901.)

SOLUBILITY OF SODIUM NITRITE IN AQUEOUS SOLUTIONS OF SODIUM NITRATE AND VICE VERSA AT SEVERAL TEMPERATURES.

(Oswald, 1912, 1914.)

Results at 0°.		Results at 21°.		Results at 52°.		Results at 103°.	
Gms. per 100 Gms. H_2O.		Gms. per 100 Gms H_2O.		Gms. per 100 Gms. H_2O.		Gms. per 100 Gms. H_2O.	
$NaNO_2$.	$NaNO_3$.	$NaNO_2$.	$NaNO_3$.	$NaNO_2$.	$NaNO_3$.	$NaNO_2$.	$NaNO_3$.
73	0	84.75	0	108.8	0	160	0
68	19	81.1	9.6	104.3	20.6	153.3	33.2
67	36.3	79.7	23.5	99.5	43.2	148.8	58.8
64.9	41.7*	73.8	50.8	98.8	82 *	142.4	116 *
50.3	46.8	73.1	54.5*	65.2	88	100	126.8
30.2	55.4	64.2	56.7	44.2	92.9	60.1	142.9
0	74.2	46.8	62.8	27.2	101.4	0	181.2
		21.6	74.7	14.7	109		
		0	89.3	0	118		

* Both salts in solid phase.

Similar results are also given for 18°, 65°, 81° and 92°.

100 gms. H_2O, simultaneously saturated with both salts, contain 53.9 gms. $NaNO_2$ + 11.8 gms. Na_2SO_4 at 16°. (Oswald, 1914.)

SOLUBILITY OF MIXTURES OF SODIUM NITRITE AND SILVER NITRITE IN WATER AT 14° AND AT 22°. (See also p. 620.)

(Oswald, 1912, 1914.)

Results at 14°.		Results at 22°.		Solid Phase in Each Case.
Gms. per 100 Gms. H_2O.		Gms. per 100 Gms. H_2O.		
$NaNO_2$.	$AgNO_2$.	$NaNO_2$.	$AgNO_2$.	
55	15.2	58.3	21.5	$AgNO_2+Na_2Ag_2(NO_2)_4.H_2O$
74.7	11.3	78.3	13.4	$NaNO_2+Na_2Ag_2(NO_2)_4.H_2O$

100 gms. abs. methyl alcohol dissolve 4.43 gms. $NaNO_2$ at 19.5°.
100 gms. abs. ethyl alcohol dissolve 0.31 gm. $NaNO_2$ at 19.5°. (de Bruyn, 1892.)

SODIUM RHODONITRITE $Na_6Rh_2(NO_2)_{12}$.

100 gms. H_2O dissolve 40 gms. at 17°, and 100 gms. at 100°. (Leidie, 1890.)

SODIUM OLEATE $C_8H_{17}CH:CH(CH_2)_7COONa$.

SOLUBILITY IN WATER AND AQUEOUS BILE SALTS.

(Moore, Wilson and Hutchinson, 1909)

Solvent.	Gms. Oleate per 100 Gms. Sat. Sol.
Water	5
Aq. 5% Bile Salts	7.6
Aq. 5% Bile Salts + 1% Lecithin	11.6

SODIUM OXALATE $Na_2C_2O_4$.

SOLUBILITY IN WATER.

(Souchay and Leussen, 1856; Pohl, 1852.)

t°.	15.5°.	21.8°.	100°.
Gms. $Na_2C_2O_4$ per 100 gms. H_2O	3.22	3.74	6.33

100 gms. sat. solution of sodium oxalate in water contain 3.09 gms. $Na_2C_2O_4$ at 15° and 4.28 gms. at 50°. (Colani, 1916.)

100 gms. 95% formic acid dissolve 8.8 gms. $Na_2C_2O_4$ at 19.3°. (Aschan, 1913.)

SODIUM OXALATE

SOLUBILITY OF MIXTURES OF SODIUM OXALATE AND OXALIC ACID IN WATER AT 25°. (Foote and Andrew, 1905.)

Gms. per 100 Gms. Solution. $H_2C_2O_4$.	Gms. per 100 Gms. Solution. $Na_2C_2O_4$.	Mols. per 100 Mols. H_2O. $H_2C_2O_4$.	Mols. per 100 Mols. H_2O. $Na_2C_2O_4$.	Solid Phase.
10.20	...	2.274	...	$H_2C_2O_4.2H_2O$
10.50	0.83	2.370	0.130	$H_2C_2O_4.2H_2O + HNaC_2O_4.H_2O$
9.15	0.71	2.032	0.106	Double Salt, $HNaC_2O_4.H_2O$
6.88	0.86	1.493	0.125	"
1.14	1.25	0.234	0.172	"
0.47	3.20	0.098	0.446	"
0.42	3.85	0.090	0.541	$HNaC_2O_4.H_2O + Na_2C_2O_4$
...	3.60	...	0.502	$Na_2C_2O_4$

SOLUBILITY OF MIXTURES OF SODIUM OXALATE AND OTHER SODIUM SALTS IN WATER AT 15° AND AT 50°. (Colani, 1916)

t°.	Gms. per 100 Gms Sat. Solution.	Solid Phase.
15	0.027 $Na_2C_2O_4$ + 26.28 NaCl	$Na_2C_2O_4$+NaCl
50	0.063 " + 26.64 "	" + "
15	0.86 " + 10.26 Na_2SO_4	$Na_2C_2O_4+Na_2SO_4.10H_2O$
50	0.22 " + 31.95 "	" $+Na_2SO_4$
15	0.051 " + 45.86 $NaNO_3$	$Na_2C_2O_4+NaNO_3$
50	0.047 " + 53 06 "	" + "

EQUILIBRIUM IN THE SYSTEM SODIUM OXALATE, URANYL OXALATE AND WATER AT 15° AND 50°. (Colani, 1917)

Results at 15°.

Gms. per 100 Gms. Sat Sol $Na_2C_2O_4$	Gms. per 100 Gms. Sat Sol $UO_2C_2O_4$	Solid Phase.
3.09	0	$Na_2C_2O_4$
4.93	3.14	" +2 1.2 5
1.80	5.01	2.1 2.5+2.4.5.11
0.80	2.65	2 4 5.11+$UO_2C_2O_4.3H_2O$
0	0.47	$UO_2C_2O_4.3H_2O$

Results at 50°.

Gms. per 100 Gms. Sat Sol $Na_2C_2O_4$	Gms. per 100 Gms. Sat Sol $UO_2C_2O_4$	Solid Phase.
4 28	0	$Na_2C_2O_4$
9.03	13.69	" +2.1 2 5
4.62	12.33	2 1.2 5+2.2.3.5
3.60	9 84	2 2 3 5+2.4.5 11
1.01	3.58	2.4 5 11+$UO_2C_2O_4.3H_2O$
0	1	UO_2 C_2O_4 $3H_2O$

2.1.2.5 = $Na_2(UO_2)(C_2O_4)_2.5H_2O$, 2.2.3.5 = $Na_2(UO_2)_2(C_2O_4)_3.5H_2O$, 2.4.5.11 = $Na_2(UO_2)_4.(C_2O_4)_5.11H_2O$.

SODIUM PALMITATE $CH_3(CH_2)_{14}COONa$.

100 gms. sat. solution in H_2O contain 0.2 gm. sodium palmitate.

100 gms. sat. solution in 5% aq. bile salts contain 1 gm. sodium palmitate.

100 gms. sat. solution in 5% aq. bile salts + 1% lecithin contain 2.4 gms. sodium palmitate. (Moore, Wilson and Hutchinson, 1909.)

SOLUBILITY OF SODIUM PALMITATE IN PALMITIC ACID. (Donnan and White, 1911.)

t°.	Gms. Na Palmitate per 100 Gms. Liquid Phase.	Gms. Na Palmitate per 100 Gms Solid Phase (Na Palmitate+ Palmitic Acid).	t°.	Gms. Na Palmitate per 100 Gms. Liquid Phase.	Gms Na Palmitate per 100 Gms. Solid Phase (Na Palmitate+ Palmitic Acid).
60.2	2.3	0.7	71	22.60	25.38
62	4.96	11.12	72.9	28.65	35.05
64.4	7.98	13.78	73.5	29.07	35.23
66.65	12.28	16 36	76	30.7	35.9
67.75	13.72	18.70	79.2	33.36	35.66
68.95	15.56	26.55	82	36.02	39.64

The solid phases form three series of solid solutions.

A special apparatus was devised for preparing the saturated solutions and filtering from the solid phases.

SODIUM *p* NITROPHENOL $C_6H_4.ONa(1).NO_2(4)$.

SOLUBILITY IN WATER AND IN AQUEOUS NORMAL SOLUTIONS OF NON-ELECTROLYTES.
(Goldschmidt, 1895.)

t°.	Gms. $C_6H_4.ONa(1).NO_2(4)$ per 100 Gms. Solution in: Water.	Alcohol.	Urea.	Glycerine.	Acetone.	Propionitril.	Acetonitril.	Urethane.
23.7	5.597	5.615	6.244	6.188	6.225	6.257	6.065	6.520
28.6	6.721	6.874	7.489	7.440	7.498	7.571	7.328	7.889
30.6	7.256	...	...	...	...	...	...	...
33.6	8.125	8.318	9.000	9.025	9.025	9.066	8.886	9.507
35.9	8.851	...	...	...	...	...	...	...
36.1	8.883	...	9.683	9.688	9.665	9.911	9.667	10.248
40.2	9.881	10.147	10.666	10.777	10.695	10.905	10.667	11.379
45.2	11.235	11.513	12.068	12.229	...	...	...	12.869
50.1	12.730	13.133	13.555	13.785	...	...	...	...

The solid phase is $C_6H_4ONa.NO_2.4H_2O$ below 36°, and $C_6H_4ONa.NO_2.2H_2O$ above 36° in each case.

SODIUM PHOSPHATE (Ortho) $Na_3PO_4.12H_2O$.

SOLUBILITY IN WATER.
(Mulder).

t°.	Gms. per 100 Gms. H_2O.	t°.	Gms. per 100 Gms. H_2O.	t°.	Gms. per 100 Gms. H_2O.
0	1.5	25	15.5	60	55
10	4.1	30	20	80	81
20	11	40	31	100	108
		50	43		

SODIUM Hydrogen PHOSPHATE $Na_2HPO_4.12H_2O$.

SOLUBILITY IN WATER.
(Shiomi, 1908; Menzies and Humphrey, 1912.)

t°.	Gms. Na_2HPO_4 per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. Na_2HPO_4 per 100 Gms. H_2O.	Solid Phase.
−0.43	1.42	Ice	45	67.3	$Na_2HPO_4.7H_2O$
−0.24	0.70	"	47.23	76.58 (S)	"
−0.5 Eutec.	...	" $+Na_2HPO_4.12H_2O$	48.3 tr. pt.	...	$Na_2HPO_4.7H_2O+$ $Na_2HPO_4.2H_2O$
+0.05	1.67	$Na_2HPO_4.12H_2O$	48 "	... (S)	"
10.26	3.55 (S)	"	50	80.2	$Na_2HPO_4.2H_2O$
15.11	5.23 (S)	"	55.17	81.4 (S)	"
20	7.66	"	60	82.9	"
25	12	"	70.26	88.11 (S)	"
30.21	20.81 (S)	"	80	92.4	"
30.76	23.41 (S)	"	89.74	102.87 (S)	"
32	25.7	"	90.2	101.1	"
33.04	30.88 (S)	"	95 tr. pt.	...	" $+ Na_2HPO_4$
34	33.8	"	95.2 "	... (S)	" "
35.2 tr. pt.	...	" $+Na_2HPO_4.7H_2O$	96.2	104.6	Na_2HPO_4
36.45 "	... (S)	" "	99.77	102.15 (S)	"
37.27	47.51 (S)	$Na_2HPO_4.7H_2O$	105	103.3	"
39.2	51.8	"	120	99.2	"

Results marked (S) by Shiomi, all others by Menzies and Humphrey.

100 gms. H_2O dissolve 12.2 gms. Na_2HPO_4 at 25°, determined by refractometer. (Osaka, 1903–8.)

100 gms. H_2O dissolve 5.23 gms. Na_2HPO_4 at 15°, $d_{15} = 1.049$. (Greenish and Smith, 1901.)

100 gms. alcohol of $d_{15} = 0.941$ dissolve 0.33 gm. Na_2HPO_4 at 15.5°.

SODIUM Dihydrogen PHOSPHATE NaH_2PO_4.

SOLUBILITY IN WATER.

(Imadsu, 1911–12.)

t°.	Gms. NaH_2PO_4 per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. NaH_2PO_4 per 100 Gms. H_2O.	Solid Phase.
0.1	57.86	$NaH_2PO_4.2H_2O$	45	148.20	$NaH_2PO_4.H_2O$
5	63.82	"	50	158.61	"
10	69.87	"	55	170.85	"
15	76.72	"	57	175.81	"
20	85.21	"	57.4 tr. pt.	...	" $+NaH_2PO_4$
25	94.63	"	60	179.33	NaH_2PO_4
30	106.45	"	65	184.99	"
35	120.44	"	69	190.24	"
40	138.16	"	80	207.29	"
40.8 tr. pt.	...	" $+NaH_2PO_4.H_2O$	90	225.31	"
41	142.55	$NaH_2PO_4.H_2O$	99.1	246.56	"

SODIUM Acid PHOSPHATE $NaH_2PO_4.H_3PO_4$.

SOLUBILITY IN WATER AND IN ANHYDROUS PHOSPHORIC ACID, DETERMINED BY THE SYNTHETIC METHOD.

(Parravano and Mieli, 1908.)

Solubility in Water.						Solubility in H_3PO_4.	
t°.	Gms. NaH_2PO_4-H_3PO_4 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. NaH_2PO_4.-H_3PO_4 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. NaH_2PO_4.-H_3PO_4 per 100 Gms. Sat. Sol.
−5.7	20.77	Ice	79.7	87.48	NaH_2PO_4	98.5	52.72
−7.9	26.92	"	85	88.65	"	111	69.59
−11.4	34.15	"	101.7	91.47	"$+NaH_2PO_4.H_3PO_4$	119	77.55
−38	56.66	"	104.5	92.67	$NaH_2PO_4.H_3PO_4$	122	81.71
−34	80.46	NaH_2PO_4	110	95.79	"	123	87.20
41	81.82	"	119	97.99	"		
51.7	83.68	"	126.5	100	"	m. pt. of the H_3PO_4 = 40.6°	

Data are also given for the fusion points of $NaH_2PO_4 + H_3PO_4$.

Fusion-point data for mixtures of $NaPO_3 + Na_4P_2O_4$ are given by Parravano and Calcagni (1908, 1910.)

EQUILIBRIUM IN THE SYSTEM SODIUM HYDROXIDE, PHOSPHORIC ACID AND WATER AT 25°.

(D'Ans and Schreiner, 1910a.)

Mols. per 1000 Gms. Sol.		Solid Phase.	Mols. per 1000 Gms. Sol.		Solid Phase.
Na.	PO_4.		Na.	PO_4.	
13.32	...	$NaOH.H_2O$	6.76	4.88	$Na_2HPO_4.7H_2O$
4.28	0.040	$Na_3PO_4.12H_2O$	7.31	5.55	" unstable
3.24	0.183	"	6.76	4.88	" $+Na_2HPO_4.2H_2O$
2.24	0.752	"	6.19	4.68	$Na_2HPO_4.2H_2O$
2.73	1.08	"	6.01	4.67	"
3.48	1.33	$Na_3PO_4.12H_2O+Na_2HPO_4.12H_2O$	5.12	4.36	"
2.62	1.09	$Na_2HPO_4.12H_2O$	4.81	4.22	"
1.56	0.78	"	4.36	4.08	"
2.38	1.60	"	4.06	4.03	"
3.18	2.24	"	4.19	4.38	"
4.65	3.55	"	4.32	4.96	"
5.63	3.87	"	4.65	5.89	"
6.31	4.63	$Na_2HPO_4.7H_2O$	4.88	6.40	"

SODIUM Pyro**PHOSPHATE** $Na_4P_2O_7.10H_2O$.

SOLUBILITY IN WATER.
(Mulder; Poggiale.)

t°.	Gms. per 100 Gms. H_2O.	t°.	Gms. per 100 Gms. H_2O.	t°.	Gms. per 100 Gms. H_2O.
0	3.16	25	8.14	60	21.83
10	3.95	30	9.95	80	30.04
20	6.23	40	13.50	100	40.26
		50	17.45		

SODIUM Pyro**PHOSPHATES.**

SOLUBILITY IN WATER.
(Giran, 1903a.)

Salt.	Formula.	t°.	Gms. Anhydrous Salt per 100 cc. Sat. Sol.
Monosodium Pyrophosphate	$NaH_3P_2O_7$	18	62.7
Disodium Pyrophosphate	$Na_2H_2P_2O_7.6H_2O$	18	14.95
Trisodium Pyrophosphate	$Na_3HP_2O_7.6H_2O$	18	28.17

SODIUM PHOSPHITES

SOLUBILITY OF SODIUM PHOSPHITES, ETC., IN WATER.

Salt.	Formula.	t°.	Gms. Salt per 100 Gms. H_2O.	Authority.
Hydrogen Phosphite	$(NaH)HPO_3.2\frac{1}{2}H_2O$	0	56	(Amat.—Compt. rend. 106, 1351, '88.)
"	"	10	66	
"	"	42	193	
Hypophosphate	$Na_4P_2O_6.10H_2O$	cold	3.3	(Salzer—Liebig's Ann. 211, 1, '82.)
Hydrogen Hypophosphate	$Na_3HP_2O_6.9H_2O$	?	4.5	
Tri Hydrogen "	$NaH_3P_2O_6 3H_2O$	cold	6.7	
Di Hydrogen "	$Na_2H_2P_2O_6.6H_2O$	cold	2.2	(Salzer—Liebig's Ann. 187, 331, '77)
Di Hydrogen "	$Na_2H_2P_2O_6.6H_2O$	b. pt.	20.0	
Hypophosphite	$(NaH)HPO_2.H_2O$	25	100.0	(U. S. P.)
Hypophosphite	$(NaH)HPO_2.H_2O$	b. pt.	830	"

100 gms. H_2O dissolve 108.7 gms. anhydrous sodium hypophosphite (NaH_2PO_2) at 15°, d_{15} of sat. sol. = 1.388. (Greenish and Smith, 1901.)

SODIUM (Double) **PHOSPHATE, FLUORIDE** $Na_3PO_4.NaF.12H_2O$.

100 gms. water dissolve 12 gms. of the double sodium salt at 25°, and 57.5 gms. at 70°. Sp. Gr. of solution at 25° = 1.0329; at 70° = 1.1091. (Briegleb, 1856.)

SODIUM PICRATE $C_6H_2(NO_2)_3.ONa.H_2O$.

SOLUBILITY IN WATER AND IN AQUEOUS SOLUTIONS AT 25°.
(Fisher and Miloszewski, 1910.)

100 cc. H_2O dissolve 4.247 gms. $C_6H_2(NO_2)_3.ONa.H_2O$ at 25°.

Solubility in Aq. Solution of:	Gms. $C_6H_2(NO_2)_3.ONa.H_2O$ per 100 cc. Aq. Solution of Normality:							
	0.01.	0.02.	0.04.	0.066.	0.10.	0.25.	0.5.	1.
Na_2CO_3	4.159	4.044	3.807	3.434	3.187	2.017	1.120	0.611
NaCl	4.189	3.956	3.677	3.335	3.021	1.678	0.846	0.410
Na_2SO_4	4.246	4.102	3.879	3.651	3.195	2.053	1.156	0.552
Na_3PO_4	4.235	4.051	3.814	3.562	3.225	2.219	1.329	0.705
NaOH	4.192	4.048	3.715	3.339	2.941	1.781	0.921	0.371
$NaNO_3$	4.154	4.029	3.710	3.363	3.041	1.932	0.943	0.684
NaBr	4.190	4.117	3.770	3.384	3.024	1.777	0.912	0.499

Data for the solubility of sodium picrate and the sodium salts of other nitrophenols in aqueous alcohol and acetone solutions at 25° are given by Fisher (1914).

SODIUM SALICYLATE $C_6H_4.OH.COONa$.

SOLUBILITY IN AQUEOUS ETHYL ALCOHOL AT 25°. (Seidell, 1909, 1910)

Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. C_6H_4OH-COONa per 100 Gms. Sat. Sol.	Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms C_6H_4OH-COONa per 100 Gms. Sat. Sol.
0	1.256	53.56	60	1.066	38.40
10	1.235	52.10	70	1.016	33
20	1.205	50.20	80	0.957	25
30	1.176	48	90	0.885	15
40	1.142	45.50	92.3	0.864	12
50	1.106	42.20	100	0.805	3.82

100 gms. sat. solution in water contain 51.8 gms. $C_6H_4OHCOONa$ at 15° and d_{15} of the sat. sol. is 1.249. (Greenish and Smith, 1901.) See also last line of first table on p. 590.

100 gms. propyl alcohol dissolve 1.16 gms. $C_6H_4OHCOONa$ at ord. temp. (Schlamp, 1894.)

Sodium salicylate distributes itself between olive oil and water at 15° in the ratio of 0.156 gm. $C_6H_4OHCOONa$ per 100 cc. oil layer and 1.444 gms. per 100 cc. aqueous layer. (Harrass, 1903.)

SODIUM SELENATE $Na_2SeO_4.10H_2O$.

SOLUBILITY IN WATER. (Funk, 1900a.)

t°.	Gms. Na_2SeO_4 per 100 Gms. Solution.	Mols. Na_2SeO_4 per 100 Mols. H_2O.	Solid Phase.	t°	Gms. Na_2SeO_4 per 100 Gms. Solution.	Mols. Na_2SeO_4 per 100 Mols. H_2O.	Solid Phase.
0	11.74	1.26	$Na_2SeO_4.10H_2O$	35.2	45.47	7.94	Na_2SeO_4
15	25.01	3.18	"	39.5	45.26	7.87	"
18	29.00	3.90	"	50	44.49	7.63	"
25.2	36.91	5.57	"	75	42.83	7.14	"
27	39.18	6.13	"	100	42.14	6.93	"
30	44.05	7.50	"				

Sp. Gr. of saturated solution at 18° = 1.315.

SODIUM SILICATE $Na_2SiO_3.9H_2O$.

SOLUBILITY IN AQUEOUS SODIUM HYDROXIDE AND SODIUM CHLORIDE SOLUTIONS. (Vesterberg, 1912.)

Solvent.	t°.	d_{17} of Sat Sol.	Gms. per 100 cc. Sat. Solution. Na_2O.	SiO_2	= $Na_2SiO_3.9H_2O$.	NaCl.
Approx. 0.5 *n* NaOH	17.5	1.129	6.942	5.419 =	25.56	...
" " NaCl	17.5	1.150	7.347	7.172	33.83	2.297
Saturated NaCl Solution	19	1.258	4.563	4.376	20.64	27.91

Solid phase $Na_2SiO_3.9H_2O$ in each case.

Fusion-point data for $Na_2SiO_3 + SrSiO_3$ are given by Wallace (1909). Results for $Na_2SiO_3 + Na_2WO_4$ are given by van Klooster (1910–11).

SODIUM STANNATE $Na_2SnO_3.3H_2O$.

100 gms. H_2O dissolve 67.4 gms. at 0°, and 61.3 gms. at 20°. Sp. Gr. of solution at 0° = 1.472; at 20° = 1.438. (Ordway, 1865.)

SODIUM SUCCINATE $(CH_2)_2(COONa)_2.6H_2O$.

SOLUBILITY IN WATER. (Marshall and Bain, 1910.)

t°	Gms. $(CH_2)_2(COONa)_2$ per 100 Gms. H_2O.	Solid Phase.	t°.	Gms $(CH_2)_2(COONa)_2$ per 100 Gms. H_2O.	Solid Phase.
0	21.45	$(CH_2)_2(COONa)_2.6H_2O$	50	56.3	$(CH_2)_2(COONa)_2.6H_2O$
12.5	27.38	"	62.5	78.49	"
25	34.90	"	64.9	83.38	" $+(CH_2)_2(COONa)_2$
37.5	43.64	"	75	86.63	$(CH_2)_2(COONa)_2$

SOLUBILITY OF SODIUM HYDROGEN SUCCINATE IN WATER.

(Marshall and Bain, 1910.)

t°.	Gms. $(CH_2)_2$-(COOH)(COONa) per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. $(CH_2)_2$-(COOH)(COONa) per 100 Gms. H_2O.	Solid Phase.
0	17.55	NaHSu*.$3H_2O$	38.7	63.99	NaHSu.$3H_2O$+NaHSu
2.5	27.93	"	50	67.37	NaHSu
25	39.82	"	62.5	76.15	"
37.5	60.01	"	75	86	"

EQUILIBRIUM IN THE SYSTEM SODIUM SUCCINATE, SUCCINIC ACID AND WATER.

(Marshall and Bain, 1910.)

Results at 0°.			Results at 25°.		
Gms. per 100 Gms. Sat. Sol.		Solid Phase.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
Na_2Su.	H_2Su.		Na_2Su.	H_2Su.	
0	2.68	H_2Su*	0	7.71	H_2Su
3.23	4.76	"	3.68	10.26	"
5.38	5.83	"	8.99	13.35	"
8.27	7.12	" +NaHSu.$3H_2O$	12.64	15.53	"
8.67	6.27	NaHSu.$3H_2O$	15.26	16.90	" +NaHSu.$3H_2O$
9.68	4.74	"	15.97	13.83	NaHSu.$3H_2O$
11.74	3.49	"	18.89	8.41	"
15.62	2.34	"	22.71	5.65	"
18.36	1.90	" +$Na_2Su.6H_2O$	26.88	4.08	" +$Na_2Su.6H_2O$
18.07	1.67	Na_2Su $6H_2O$	26.50	2.38	$Na_2Su.6H_2O$
17.87	0.94	"	26.11	0.85	"
17.64	...		25.87	0	"
Results at 50°.			Results at 75°.		
0	19.27	H_2Su*	0	37.64	H_2Su
5.95	22.90	"	8.22	40.38	"
10.25	25.33	"	13.14	42.50	"
15.49	28.73	"	16.93	44.38	"
19.65	31.73	" +NaHSu	19.56	45.98	" +NaHSu
20.72	26.51	NaHSu	21.88	35.60	NaHSu
22.53	18.44	"	24.30	26.82	"
25.53	13.09	"	29.45	15.28	"
28.28	9.46	"	36.11	7.79	"
30.48	7.38	"	41.26	4.93	"
37.33	4.20	" +Na_2Su $6H_2O$	45.27	4	" +$Na_2Su.H_2O$
36.85	3.88	$Na_2Su.6H_2O$	45.36	3.17	$Na_2Su.H_2O$
36.67	2.66	"	45.93	1.23	"
36.43	0	"	46.42	0	"

The following double and triple points were located:

t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	Na_2Su.	H_2Su.	
34.9	30.8	5.6	NaHSu.$3H_2O$+NaHSu+$Na_2Su.6H_2O$
37.8	19.6	25.46	NaHSu.$3H_2O$+NaHSu+H_2Su
38.7	22.47	16.44	NaHSu.$3H_2O$+NaHSu
63.4	42.92	3.64	$Na_2Su.6H_2O$+$Na_2Su.H_2O$+NaHSu
64.9	45.43	...	$Na_2Su.6H_2O$+$Na_2Su.H_2O$

* In the above tables the abbreviation Su is used for $(CH_2)_2(COO)_2$.

SODIUM SULFATE Na_2SO_4.

SOLUBILITY IN WATER.

(Mulder; Löwel, 1851; Tilden and Shenstone, 1883; Etard, 1894; Funk, 1900a; Berkeley, 1904.)

t°.	Gms. Na_2SO_4 per 100 Gms. Solution.	Gms. Na_2SO_4 per 100 Gms. Water.	Mols. Na_2SO_4 per Liter (B.).	Solid Phase.	t°.	Gms. Na_2SO_4 per 100 Gms. Solution.	Gms. Na_2SO_4 per 100 Gms. Water.	Mols. Na_2SO_4 per Liter (B.).	Solid Phase.
0	4.76	5.0	0.31	$Na_2SO_4.10H_2O$	50	31.8	46.7	2.92	Na_2SO_4
5	6.0	6.4	...	"	60	31.2	45.3	2.83	"
10	8.3	9.0	0.631	"	80	30.4	43.7	2.69	"
15	11.8	13.4	...	"	100	29.8	42.5	2.60	"
20	16.3	19.4	1.32	"	120	29.5	41.95	...	"
25	21.9	28.0	...	"	140	29.6	42	...	"
27.5	25.6	34.0	...	"	160	30.7	44.25	...	"
30	29.0	40.8	2.63	"	230	31.7	46.4	...	"
31	30.6	44.0	...	"	0	16.3	19.5	...	$Na_2SO_4.7H_2O$
32	32.3	47.8	...	"	5	19.4	24	...	"
32.75	33.6	50.65	3.11	"	10	23.1	30	...	"
33	33.6	50.6	...	Na_2SO_4	15	27.0	37	...	"
35	33.4	50.2	...	"	20	30.6	44	...	"
40	32.8	48.8	3.01	"	25	34.6	53	...	"

The very carefully determined values of Berkeley are as follows:

t°.	d_t of Sat. Sol.	Gms. Na_2SO_4 per 100 Gms. H_2O.	Solid Phase.	t°.	d_t of Sat. Sol.	Gms. Na_2SO_4 per 100 Gms. H_2O.	Solid Phase.
0.70	1.0432	4.71	$Na_2SO_4.10H_2O$	32.5 tr. pt.		...	$Na_2SO_4.10H_2O+Na_2SO_4$
10.25	1.0802	9.21	"	33.5	1.3307	49.39	Na_2SO_4
15.65	1.1150	14.07	"	38.15	1.3229	48.47	"
20.35	1.1546	...	"	44.85	1.3136	47.49	"
24.90	1.2067	27.67	"	60.10	1.2918	45.22	"
27.65	1.2459	34.05	"	75.05	1.2728	43.59	"
30.20	1.2894	41.78	"	89.85	1.2571	42.67	"
31.95	1.3230	47.98	"	101.9*	1.2450	42.18	"

* B. pt.

The following additional data at high temperatures, determined by the sealed tube method, are given by Wuite (1913–14).

t°.	Mol. Per cent Na_2SO_4.	Gms. Na_2SO_4 per 100 Gms. H_2O.	Solid Phase.	t°.	Mol Per cent Na_2SO_4.	Gms. Na_2SO_4 per 100 Gms. H_2O.	Solid Phase.
62	5.39	44.92	Na_2SO_4 (rhombic)	208	5.39	44.92	Na_2SO_4 (rhombic)
70	5.27	43.87	" "	235 tr. pt.		...	" " +monoclinic
80	5.18	43.07	" "	241	5.39	44.92	Na_2SO_4 (monoclinic)
120	5.04	41.84	" "	250	5.04	41.84	" "
190	5.255	43.74	" "	279	4.12	33.84	" "
192	5.27	43.87	" "	319	2.56	20.71	" "

Supersolubility curves for the ice phase, $Na_2SO_4.7H_2O$ phase and Na_2SO_4 phase were determined by Hartley, Jones and Hutchinson (1908) by agitating mixtures of sodium sulfate and water contained in sealed tubes, and noting the points at which spontaneous crystallization occurred while the tubes were gradually cooled. The effect of mechanical friction, produced by bits of glass, garnet, etc., was also studied.

SODIUM SULFATE

Solubility of Mixtures of Sodium Sulfate and Magnesium Sulfate in Water (Astrakanite) $Na_2Mg(SO_4)_2.4H_2O$.

(Roozeboom, 1887, 1888.)

t°.	Mols. per 100 Mols. H_2O.		Grams per 100 Grams H_2O.		Solid Phase.
	Na_2SO_4.	$MgSO_4$.	Na_2SO_4.	$MgSO_4$.	
22	2.95	4.70	23.3	31.4	Astrakanite
24.5	3.45	3.68	27.2	24.6	"
30	3.59	3.59	28.4	24.1	"
35	3.71	3.71	29.4	24.8	"
47	3.6	3.6	28.4	24.1	"
22	2.95	4.70	23.3	31.4	Astrakanite + Na_2SO_4
24.5	3.45	3.62	27.2	24.2	"
30	4.58	2.91	36.1	19.1	"
35	4.3	2.76	33.9	18.44	"
18.5	3.41	4.27	43.0	45.5	Astrakanite + $MgSO_4$
22	2.85	4.63	35.2	48.9	"
24.5	2.68	4.76	32.5	50.3	"
30	2.3	5.31	25.9	55.0	"
35	1.73	5.88	23.5	59.4	

Solubility of Mixtures of Sodium Sulfate, Potassium Chloride, Potassium Sulfate, etc., in Water.

(Meyerhoffer and Saunders, 1899.)

t°.	Sp. Gr. of Solutions.	Mols. per 1000 Mols. H_2O.				Solid Phase.
		SO_4	K_2	Na_2	Cl_2	
*4.4	...	5.42	14.39	51.83	60.8	$K_3Na(SO_4)_2+Na_2SO_4.10H_2O+KCl+NaCl$
0.2	...	3.35	12.78	50.93	60.36	$Na_2SO_4.10H_2O+KCl+NaCl$
− 0.4	...	3.59	16.38	40.75	53.54	$Na_2SO_4.10H_2O+KCl+K_3Na(SO_4)_2$
16.3	...	4.72	17.58	50.56	63.42	$K_3Na(SO_4)_2+KCl+NaCl$
24.8	1.2484	4.37	20.00	48.36	64.01	$K_3Na(SO_4)_2+KCl+NaCl$
*16.3	...	16.29	9.16	61.06	53.93	$K_3Na(SO_4)_2+NaCl+Na_2SO_4.10H_2O+Na_2SO_4$
24.5	1.2625	14.45	9.90	58.46	53.91	$K_3Na(SO_4)_2+NaCl+Na_2SO_4$
0.3	...	2.75	25.77	17.93	40.95	$K_3Na(SO_4)_2+KCl+K_2SO_4$
25.0	1.2034	2.94	36.20	14.80	48.06	$K_3Na(SO_4)_2+KCl+K_2SO_4$
*17.9	1.2474	13.84	0.0	62.57	48.70	$Na_2SO_4.10H_2O+Na_2SO_4+NaCl$
*30.1	1.2890	50.41	10.08	40.33	0.0	$K_3Na(SO_4)_2+Na_2SO_4.10H_2O+Na_2SO_4$
−21.4	...	...	...	46.61	46.36	$NaCl.2H_2O+Na_2SO_4.10H_2O$
−23.7	...	...	10.51	39.58	50.09	$NaCl.2H_2O+KCl$
−10.9	...	1.45	30.68	...	29.23	$KCl+K_2SO_4$
− 3	...	16.25	10.03	6.21	...	$K_3Na(SO_4)_2+Na_2SO_4.10H_2O$
− 3	...	16.24	10.03	6.21	...	$K_3Na(SO_4)_2+K_2SO_4$
−14	...	1.39	25.59	8.78	32.94	$K_3Na(SO_4)_2+Na_2SO_4.10H_2O+KCl$
−14	...	1.39	25.59	8.78	32.94	$K_3Na(SO_4)_2+K_2SO_4+KCl$
−23.3	...	0.41	15.15	44.20	58.97	$Na_2SO_4.10H_2O+KCl+NaCl.2H_2O$

* Indicates transition points.

SOLUBILITY OF SODIUM SULFATE IN AQUEOUS SOLUTIONS OF SODIUM ACETATE AT 25°.

(Fox, 1909.)

Gms. per 100 Gms. Sat Sol. CH_3COONa.	Na_2SO_4.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. CH_3COONa	Na_2SO_4.	Solid Phase.
0	21.9	$Na_2SO_4.10H_2O$	12.58	13.50	$Na_2SO_4.10H_2O$
4.10	17.72	"	16.26	11.50	"
7.71	16.48	"	20.68	8.10	"

SOLUBILITY OF SODIUM SULFATE IN AQUEOUS SODIUM CHLORIDE AT 15°.

((Schreinemakers and de Baat, 1909.)

Gms per 100 Gms. Sat. Sol. NaCl.	Na_2SO_4	Solid Phase.	Gms per 100 Gms Sat. Sol. NaCl.	Na_2SO_4.	Solid Phase.
5.42	7.86	$Na_2SO_4.10H_2O$	21.03	5.26	$Na_2SO_4.10H_2O$
11.51	5.87	"	23.39	5.64	" +NaCl
15.97	5.23	"	25.21	2.26	NaCl

SOLUBILITY OF SODIUM SULFATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT DIFFERENT TEMPERATURES.

(Seidell, 1902.)

Results at 10°.			Results at 21.5°.			Results at 27°.		
Sp. Gr. of Solutions.	Gms. per 100 Gms. H_2O. NaCl.	Na_2SO_4.	Sp. Gr. of Solutions.	Gms. per 100 Gms. H_2O. NaCl.	Na_2SO_4.	Sp. Gr. of Solutions.	Gms. per 100 Gms. H_2O. NaCl.	Na_2SO_4.
1.080	0.0	9.14	1.164	0.0	21.33	1.228	0 0	31.10
1.083	4.28	6.42	1.169	9.05	15.48	1.230	2.66	28.73
1.102	9.60	4.76	1.199	17 48	13 73	1.230	5.29	27.17
1.150	15.65	3.99	1.214	20.41	13.62	1.235	7.90	26.02
1.164	21.82	3.97	1.243	26.01	15.05	1.259	16.13	24.83
1.192	28.13	4.15	1.244	26.53	14 44	1.253	18.91	21.39
1.207	30.11	4.34	1.244	27.74	13.39	1.249	19.64	20.11
1.217	32.27	4.59	1.244	31.25	10.64	1.245	20.77	19.29
1.223	33.76	4.75	1.243	31.80	10.28	1.238	32.33	9.53
			1.245	32.10	8.43			
			1.219	33.69	4.73			
			1.212	34.08	2.77			
			1.197	35.46	0.00			

Results at 30°.			Results at 33°.			Results at 35°.		
Sp. Gr. of Solutions.	Gms. per 100 Gms. H_2O. NaCl.	Na_2SO_4.	Sp. Gr. of Solutions.	Gms. per 100 Gms. H_2O. NaCl.	Na_2SO_4.	Sp. Gr. of Solutions.	Gms. per 100 Gms. H_2O. NaCl.	Na_2SO
1.281	0.0	39.70	1.329	0.0	48.48	1.324	0.0	47.94
1.282	2.45	38.25	1.323	1.22	46.49	1.314	2.14	43.75
1.284	5.61	36.50	1.318	1.99	45.16	1.256	13.57	26.26
1.290	7.91	35.96	1.315	2.64	44.09	1.238	18.78	19.74
1.276	10.61	31.64	1.309	3.47	42.61	1.231	31.91	8.28
1.270	12.36	29.87	1.265	12.14	29.32	1.193	35.63	0.00
1.258	15.65	25.02	1.237	21.87	16.83			
1.249	18.44	21.30	1.234	32.84	8.76			
1.244	20.66	19.06	1.217	33.99	4.63			
1.236	32.43	9.06	1.208	34.77	2.75			

SOLUBILITY OF SODIUM SULFATE IN AQUEOUS SOLUTIONS OF SODIUM CHLORIDE AT 25°.

(Cameron, Bell and Robinson, 1907.)

d_{25} of Sat. Sol.	Gms. per 100 Gms. H_2O. NaCl.	Na_2SO_4.	Solid Phase.	d_{25} of Sat. Sol.	Gms. per 100 Gms. H_2O. NaCl.	Na_2SO_4.	Solid Phase.
1.2173	2.96	26.60	$Na_2SO_4.10H_2O$	1.2429	26.54	12.64	Na_2SO_4
1.2162	5.79	24.32	"	1.2438	31.06	9.98	"
1.2150	9.90	21.41	"	1.2451	32.41	9.93	"
1.2275	13.43	19.62	"	1.2453	33	9.84	" +NaCl
1.2385	15.82	19.64	"	1.2309	33.81	6.66	NaCl
1.2571	19.13	20.73	" $+Na_2SO_4$	1.2162	34.60	3.38	"
1.2476	23.22	16.28	Na_2SO_4	1.2002	35.80	0	"

Data are also given for the system sodium sulfate, sodium chloride, calcium sulfate and water at 25°.

SOLUBILITY OF SODIUM SULFATE IN AQUEOUS SOLUTIONS OF SODIUM HYDROXIDE AT 25°.

(D'Ans and Schreiner, 1910.)

Mols. per 1000 Gms. Sat. Sol. $(NaOH)_2$.	Na_2SO_4.	Solid Phase.	Mols. per 1000 Gms. Sat. Sol. $(NaOH)_2$.	Na_2SO_4.	Solid Phase.
0.074	1.41	$Na_2SO_4.10H_2O$	2.82	0.24	Na_2SO_4
0.70	1.08	"	3.52	0.126	"
1.47	0.90	" $+Na_2SO_4$	5.83	0.013	"
2.02	0.59	Na_2SO_4	6.62	0	$NaOH.H_2O$

SOLUBILITY OF SODIUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°.

(D'Ans, 1906; 1909c; 1913.)

Mols. per 1000 Gms. Sat. Sol. H_2SO_4.	Na_2SO_4.	Solid Phase.	Mols. per 1000 Gms. Sat. Sol. SO_3.	Na_2SO_4.	Solid Phase.
0	1.541	$Na_2SO_4.10H_2O$	8.70	0.076	$NaH_3(SO_4)_2.H_2O$
0.286	1.671	"	8.86	0.156	"
0.338	1.742	"	8.93	0.273	"
0.60	1.85	"	8.84	0.527	" (unstable)
0.763	2	"	8.70	0.808	" "
0.884	2.256	" $+Na_2SO_4$	8.62	0.844	" "
0.423	0.77	$NaHSO_4.H_2O$	8.61	0.899	"
0.496	0.47	"	8.87	0.445	" $+Na_2SO_4.4\frac{1}{2}H_2SO_4$
1.666	2.437	$Na_2SO_4+Na_3H(SO_4)_2$	8.93	0.437	$Na_2SO_4.4\frac{1}{2}H_2SO_4$
1.576	2.363	" $+Na_3H(SO_4)_2.H_2O$	9.08	0.394	"
2.611	2.091	$Na_3H(SO_4)_2+$ "	9.36	0.425	" $+NaHS_2O_7$
5.91*	0.409	$NaHSO_4$	9.18	0.567	$NaHS_2O_7$
6.30	0.332	"	9.42	0.728	"
6.64	0.297	" $+NaH_3(SO_4)_2.H_2O$	9.48	0.76	"
6.90	0.173	$NaH_3(SO_4)_2.H_2O$	9.48	0.953	" +?
7.36	0.071	"	9.85	0.787	?
7.74	0.047	"	9.98	0.908	?
8.12	0.037	"	9.77	1.03	unstable
8.40	0.046	"	10.16	0.797	
			10.78	0.302	

* From this point on the figures in this column are Mols.SO_3 = H_2SO_4 + SO_3.

100 cc. sat. solution of Na_2SO_4 in absolute H_2SO_4 contain 29.99 gms. Na_2SO_4 and the molecular compound which is formed contains 8 mols. H_2SO_4 per 1 mol. Na_2SO_4 and melts at about 40°. (Bergius, 1910.)

Aqueous H_2SO_4 containing 0.51 mol. per liter dissolve 2.238 mols. Na_2SO_4 per liter at 25°; Aq. H_2SO_4 of 0.779 mol. per liter dissolves 2.465 mols. Na_2SO_4 at the same temperature. (Herz, 1911–12.)

Solubility of Sodium Sulfate in Aqueous Ethyl Alcohol.
(de Bruyn, 1900.)

t°.	Concentration of Alcohol in Wt. %.	Gms. Na_2SO_4 per 100 Gms. Aq. Alcohol.	Gms. per 100 Gms. Solution. H_2O.	C_2H_5OH.	Na_2SO_4.	Solid Phase.
15	0	12.7	88.7	0	11.3	$Na_2SO_4.10H_2O$
"	9.2	6.7	85.1	8.6	6.3	"
"	19.4	2.6	78.6	18.9	2.5	"
"	39.7	0.5	60	39.5	0.5	"
"	58.9	0.1	41.1	58.8	0.1	"
"	72	0	28	72	0	"
"	0	37.4	72.8	0	27.2	$Na_2SO_4.7H_2O$
"	11.2	16.3	76.5	9.5	14	"
"	20.6	7	74.3	19.2	6.5	"
"	30.2	2	68.4	29.6	2	"
25	0	28.2	78.1	0	21.9	$Na_2SO_4.10H_2O$
"	10.6	13.9	78.5	9.3	12.2	"
"	24	4.5	72.8	22.9	4.3	"
"	54	0.4	45.6	54	0.4	" $+Na_2SO_4$
36	0	49.3	67	0	33	Na_2SO_4
"	8.8	29.2	70.6	6.8	22.6	"
"	12.8	22.4	71.2	10.5	18.3	"
"	17.9	15.4	71.1	15.5	13.4	"
"	18.1	15.3	71	15.7	13.3	"
"	28.9	5.4	66.5	28.4	5.1	"
"	48.7	0.8	50.9	48.3	0.8	"
45	0	47.9	67.6	0	32.4	"
"	9	27.5	71.3	7.1	21.6	"
"	14.5	19.2	71.8	12.1	16.1	"
"	20.6	12.3	70.6	18.4	10	"
"	31	5.1	65.6	29.5	4.9	"

The following additional determinations at 25° are given by Schreinemakers and de Baat (1909):

25	...	...	63.41	34.84	1.75	$Na_2SO_4.10H_2O$
"	...	...	49	50.5	0.5	
"	...	...	46.6	53	0.4	" $+Na_2SO_4$
"	...	...	34.9	64.95	0.15	Na_2SO_4

Between certain concentrations of the aqueous alcohol the liquid separates into two layers. The following results were obtained at 25°, 36° and 45°:

t°.	Upper Layer. Gms. H_2O.	Gms. C_2H_5OH.	Gms. Na_2SO_4.	Lower Layer. Gms. H_2O.	Gms. C_2H_5OH.	Gms. Na_2SO_4.
25	66.5	27.3	6.2	67.4	5.1	27.5
"	68.1	23.9	8.0	68.5	6.0	25.5
"	68.3	23.1	8.6	68.3	6.7	25.0
36	...	...	...	66.6	4.1	29.3
"	57.7	38.4	3.9	...	...	...
"	65.0	28.3	6.7	68.8	5.9	25.3
"	68.1	21.2	10.7	68.9	9.4	21.7
45	61.8	32.9	5.3	...	...	...
"	65.8	25.3	8.9	68.4	8.8	22.8
"	66.0	24.0	10.0	68.6	10.1	21.3

Data for equilibrium in the system $Na_2SO_4 + NaCl + C_2H_5OH + H_2O$ at 15°, 25° and 35° are given by Schreinemakers and de Baat (1909), and Schreinemakers (1910).

SOLUBILITY OF SODIUM SULFATE IN AQUEOUS PROPYL ALCOHOL AT 20°.
(Linebarger, 1892.)

Gms. C_3H_7OH per 100 Gms. Alcohol-Water Mixture.	Gms. Na_2SO_4 per 100 Gms. Sat. Solution.	Gms. C_3H_7OH per 100 Gms. Alcohol-Water Mixture.	Gms. Na_2SO_4 per 100 Gms. Sat. Solution.
42.20	1.99	56.57	0.55
49.77	1.15	60.64	0.44
55.65	0.72	62.81	0.38

100 gms. H_2O dissolve 183.7 gms. sugar + 30.5 gms. Na_2SO_4 at 31.25°, or 100 gms. sat. solution contain 52.2 gms. sugar + 9.6 gms. Na_2SO_4. (Kohler, 1897.)
100 gms. 95% formic acid dissolve 16.5 gms. Na_2SO_4 at 19°. (Aschan, 1913.)

SOLUBILITY OF SODIUM SULFATE IN AN AQUEOUS SOLUTION OF UREA.
(Löwenherz, 1895.)

Solvent.	t°.	Gms. Na_2SO_4 per 100 Gms. Sat. Sol.	The Corresponding Figure for the Solubility of Na_2SO_4 in Pure Water Was Found to be:
100 gms. H_2O+12 gms. urea	20.86	22.36	...
" "	24.83	21.21	21.62
" "	28.32	26.50	26.48
" "	29.83	28.23	...
" "	31.90	...	32.34
" "	34.85	27.73	33.09
" "	39.92	27.19	32.58

Fusion-point data for Na_2SO_4 + KCl are given by Sackur (1911–12). Results for Na_2SO_4 + $SrSO_4$ are given by Calcagni (1912–1912a). Results for Na_2SO_4 + Na_2WO_4 are given by Boeke (1907).

SODIUM BISULFATE $NaHSO_4$. (See also last table, p. 670.)

100 gms. H_2O dissolve 30 gms. $NaHSO_4$ at 16°. (Aschan, 1913.)
100 gms. H_2O dissolve 28.6 gms. $NaHSO_4$ at 25° and 50 gms. at 100°. (U.S.P. VIII.)
100 gms. 95 per cent alcohol dissolve about 1.4 gms. $NaHSO_4$ at 25°. (U.S.P. VIII.)
100 gms. 95% formic acid dissolve 30 gms. $NaHSO_4$ at 19.3°. (Aschan, 1913.)

SODIUM SULFIDE $Na_2S.9H_2O$.

SOLUBILITY IN WATER.
(Parravano and Fornaini, 1907.)

t°.	Gms. Na_2S per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. Na_2S per 100 Gms. Sat. Sol.	Solid Phase.
−10 Eutec.	9.34	$Na_2S.9H_2O$+Ice	60	29.92	$Na_2S.5\frac{1}{2}H_2O$
+10	13.36	$Na_2S.9H_2O$	70	31.38	"
15	14.36	"	80	33.95	"
18	15.30	"	90	37.20	"
22	16.20	"	48 tr. pt.	...	$Na_2S.9H_2O$+$Na_2S.6H_2O$
28	17.73	"	50	26.7	$Na_2S.6H_2O$
32	19.09	"	60	28.1	"
37	20.98	"	70	30.22	"
45	24.19	"	80	32.95	"
48.9 tr. pt.	...	" +$Na_2S.5\frac{1}{2}H_2O$	90	36.42	"
50	28.48	$Na_2S.5\frac{1}{2}H_2O$	91.5 tr. pt.	...	" +$Na_2S.5\frac{1}{2}H_2O$

Fusion-point data for Na_2S + S are given by Thomas and Rule (1917).

SODIUM Antimony SULFIDE. See Sodium Sulfoantimonate, p. 627.

SODIUM SULFITE Na_2SO_3.

SOLUBILITY IN WATER.
(Hartley and Barrett, 1909.)

t°.	Gms. Na_2SO_3 per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. Na_2SO_3 per 100 Gms. H_2O.	Solid Phase.
− 0.76	2.15	Ice	18.2	25.31	$Na_2SO_3.7H_2O$
− 1.37	4.21	"	23.5	29.92	" (unstable)
− 1.96	6.24	"	29	34.99	" "
− 2.77	9.44	"	37.2	44.08	" "
− 3.5*	12.48	" $+Na_2SO_3.7H_2O$	21.6†	...	" $+Na_2SO_3$
− 4.5	17.91	Ice (unstable)	37	28.04	Na_2SO_3
− 1.9	13.09	$Na_2SO_3.7H_2O$	47	28.13	"
+ 2	14.82	"	55.6	28.21	"
5.9	17.61	"	59.8	28.76	"
10.6	20.01	"	84	28.26	"

* Eutec. † tr. pt.

Oxidation was prevented by preparing the material and making the solubility determinations in an atmosphere of hydrogen.

Supersolubility curves for the salt are also given.

The Sp. Gr. of the sat. solution at 15° is 1.21. (Greenish and Smith, 1901.)

SODIUM HydroSULFITE $Na_2S_2O_4$.

SOLUBILITY IN WATER. (Jellinck, 1911.)

t°.	Gms. $Na_2S_2O_4$ per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. $Na_2S_2O_4$ per 100 Gms. H_2O.	Solid Phase.
−0.107	0.394	Ice	− 4.58 Eutec.	19	Ice$+Na_2S_2O_4.2H_2O$
−1.10	4	"	+20	22 (±5% error)	$Na_2S_2O_4.2H_2O$
−2.21	9	"	52 tr. pt.	27.8	" $+Na_2S_2O_4$
−3.15	13	"	20	24.1	$Na_2S_2O_4$ (unstable)
−4.17	17	"			

The pure sample was prepared by salting out the commercial product with NaCl. It is very easily oxidized to $Na_2S_2O_5$ and must be kept in an indifferent atmosphere or a vacuum. A special apparatus was required for the freezing-point determinations (ice curve) and for the solubility determinations. Great difficulty was experienced in obtaining concordant results with a given sample of $Na_2S_2O_4$.

SODIUM SULFONATES

SOLUBILITY IN WATER.

Salt.	Formula.	t°.	Gms. Anhydrous Salt per 100 Gms. H_2O.	Authority.
Sodium:				
2.5 Diiodobenzene Sulfonate	$C_6H_3I_2SO_3.Na$	22.5	6.82	(Boyle, 1909.)
3.4 " "	$C_6H_3I_2SO_3Na.H_2O$	22.5	3.47	"
β Naphthalene Sulfonate	$C_{10}H_7.SO_3Na$	23.9	6.04	(Fischer, 1906.)
" "	"	25	5.87*	(Witt, 1915.)
2 Phenathrene Sulfonate	$C_{14}H_9SO_3Na.\frac{1}{2}H_2O$	20	0.42	(Sandquist, 1912.)
3 " "	$C_{14}H_9SO_3Na.H_2O$	20	1.1	"
10 " "	$C_{14}H_9.SO_3Na.2H_2O$	20	1.63	"
Phenol Sulfonate	$C_6H_4(OH)SO_3Na.2H_2O$	15	14.7†	(Greenish & Smith,'01.)
"	"	25	19.2‡	(Seidell, 1910.)

* d_{25} = 1.019. † d_{15} = 1.067. ‡ d_{25} = 1.079

SOLUBILITY OF SODIUM β NAPHTHALENE SULFONATE IN AQUEOUS HYDROCHLORIC ACID AT 23.9°. (Fischer 1906.)

Normality of Aq. HCl.	1.0 n.	2 n.	3 n.	5 n.
Gms. $C_{10}H_7.SO_3Na$ per 100 gms. Aq. HCl	6.47	5.35	4.13	2.42

SOLUBILITY OF SODIUM PHENOL SULFONATE IN AQUEOUS ALCOHOL AT 25°.

(Seidell, 1910.)

Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_6H_4(OH)\cdot SO_3Na.2H_2O$ per 100 Gms. Sat. Sol.	Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_6H_4(OH)SO_3Na.2H_2O$ per 100 Gms. Sat. Sol.
0 (= H_2O)	1.079	19.38	60	0.919	7.5
10	1.054	17.4	70	0.886	5.1
20	1.030	15.5	80	0.852	2.9
30	1.004	13.6	90	0.820	1.1
40	0.977	11.7	95	0.810	0.8
50	0.950	9.7	100	0.800	1.5

In the 100 per cent C_2H_5OH solution, the solid phase, $C_6H_4(OH)\ SO_3Na.2H_2O$, became opaque.

100 gms. H_2O dissolve 18.25 gms. $C_6H_4(OH)SO_3Na.2H_2O$ at 14.8°, $d_{14.8}$ of sat. sol. = 1.0675. (Greenish and Smith, 1901.)

SODIUM TARTRATES

SOLUBILITY IN WATER.

Salt.	Formula.	t°.	Gms. Salt per 100 Gms. H_2O.	Authority.
Sodium Neutral Inactive Pyrotartrate	$C_5H_6O_6.Na_2.6H_2O$	20	39.73	(Schlossberg, 1900.)
" Dextro	" "	20	41.10	"
Sodium Dihydroxy Tartrate	$C_4H_4O_8Na_2.3H_2O$	0	0.039	(Fenton, 1898.)

SODIUM TELLURATE $Na_2TeO_4.2H_2O$.

100 gms. H_2O dissolve 0.77 gm. Na_2TeO_4 at 18°, and 2 gms. at 100°. Solid phase $Na_2TeO_4.2H_2O$.

100 gms. H_2O dissolve 1.43 gms. Na_2TeO_4 at 18°, and 2.5 gms. at 50°. Solid phase $Na_2TeO_4.4H_2O$. (Mylius, 1901.)

SODIUM THIOSULFATE $Na_2S_2O_3.5H_2O(I)$.

SOLUBILITY IN WATER. (Young and Burke, 1904, 1906.)

t°.	Gms. $Na_2S_2O_3$ per 100 Gms Sat. Sol.	Water.	Solid Phase.	t°.	Gms. $Na_2S_2O_3$ per 100 Gms. Sat. Sol.	Water.	Solid Phase.
0	33.40	50.15	$Na_2S_2O_3.5H_2O(I)$	0	60.47	153	$Na_2S_2O_3.H_2O(II)$
10	37.37	59.66	"	10	61.04	156.7	"
20	41.20	70.07	"	20	62.11	163.9	"
25	43.15	75.90	"	25	62.73	168.3	"
35	47.71	91.24	"	30	63.56	174.4	"
45	55.33	123.87	"	40	65.22	187.6	"
48.17*	...	...	"+$Na_2S_2O_3.2H_2O(I)$	50	66.82	201.4	"
0	52.73	111.60	$Na_2S_2O_3.2H_2O(I)$	56.5*	...	...	" +$Na_2S_2O_3$
10	53.94	117.10	"	0	46.14	85.67	$Na_2S_2O_3.6H_2O$(III and IV)
20	55.15	122.68	"	10	51.66	106.8	"
25	56.03	127.43	"	13	54.96	122	"
30	57.13	138.84	"	14.35*	...	...	" +$Na_2S_2O_3.\frac{1}{2}H_2O$.(IV)
40	59.38	146.20	"	14.3*	...	...	" +$Na_2S_2O_3.7H_2O(III)$
50	62.28	165.11	"	0	57.42	134.8	$Na_2S_2O_3.7H_2O(III)$
60	65.68	191.30	"	10	58.28	139.7	"
66.5*	...	...	"+$Na_2S_2O_3$	20	59.28	145.6	"
0	41.96	72.30	$Na_2S_2O_3.5H_2O(II)$	25	60.18	151.1	"
10	45.25	82.65	"	30	60.78	155	"
20	49.38	97.55	"	40	62.60	167.4	"
25	52.15	108.98	"	47.5	64.68	183.1	"
30	56.57	130.26	"	48.5*	...	...	" +$Na_2S_2O_3.H_2O(III)$
30.22*	...	...	"+$Na_2S_2O_3.4H_2O(II)$	47.5	64.78	183.9	$Na_2S_2O_3.H_2O(III)$
33.5	58.59	141.48	$Na_2S_2O_3.4H_2O(II)$	50	65.3	188.2	"
36.2	60.51	153.23	"	55	66.45	198.1	"
36.6	62.80	168.82	"	60	68.07	213.1	"
40.65*	...	..	"+$Na_2S_2O_3.H_2O(II)$	61*	...	...	"+ $Na_2S_2O_3$

* tr. pt.

SOLUBILITY IN WATER (*Continued*).

t°.	Gms. $Na_2S_2O_3$ per 100 Gms. Sat. Sol.	Gms. $Na_2S_2O_3$ per 100 Gms. Water.	Solid Phase.	t°.	Gms. $Na_2S_2O_3$ per 100 Gms. Sat. Sol.	Gms. $Na_2S_2O_3$ per 100 Gms. Water.	Solid Phase.
0	57.63	136	$Na_2S_2O_3.\frac{1}{2}H_2O$ (IV)	30	63.34	172.80	$Na_2S_2O_3.H_2O$ (V)
10	58.40	140.9	"	40	64.75	183.70	"
20	59.57	147.3	"	50	66.58	199.2	"
25	60.35	152.2	"	55	67.59	208.5	"
30	61.03	156.6	"	43*	...	...	" $+Na_2S_2O_3.\frac{1}{2}H_2O$ (V)
40	62.95	169.9	"	25	64.21	179.4	$Na_2S_2O_3.\frac{1}{2}H_2O$ (V)
50	65.45	189.5	"	40	64.99	185.6	"
55	67.07	203.7	"	50	66.02	194.3	"
58*	...	...	" $+Na_2S_2O_3$	60	67.4	206.7	"
0	57.63	136	$Na_2S_2O_3.2H_2O$ (V)	70	69.06	223.2	"
10	59.05	144.2	"	70*	...	...	" $+Na_2S_2O_3$
20	61.02	156.5	"	40	67.4	206.7	$Na_2S_2O_3$
25	62.30	165.3	"	50	67.76	210.2	"
30	63.56	174.4	"	60	68.48	217.3	"
35	65.27	188	"	70	69.05	223.1	"
27.5*	...	...	" $+Na_2S_2O_3.H_2O$ (V)	80	69.86	231.8	"

* tr. pt.

The authors adopted a new system of naming the hydrates, based upon their mutual transition relations. These transitions occur in such a way that the members of one group undergo transition into members of the same group and not into members of another group. Those hydrates belonging to group (I) are called primary hydrates, those belonging to group (II) are called secondary and those belonging to the (III), (IV) and (V) groups are called tertiary, quaternary and quintary respectively.

Commercial sodium thiosulfate is the primary pentahydrate, $Na_2S_2O_3.5H_2O$ (I).

100 gms. alcohol dissolve 0.0025 gm. $Na_2S_2O_3$ and 0.0034 gm. $Na_2S_2O_3.5H_2O$ at room temperature. (Bödtker, 1897.)

100 gms. alcohol of 0.941 Sp. Gr. dissolve 33.3 gms. sodium thiosulfate at 15.5°.

Data for the lowering of the freezing-point of $Na_2S_2O_3.5H_2O$ by each of the following compounds: urea, glucose, cane sugar, NaCl, $NaClO_3$, $NaNO_3$ and Na_2SO_4 are given by Bautaric (1911).

SODIUM TUNGSTATE $Na_2WO_4.2H_2O$.

SOLUBILITY IN WATER.

(Funk, 1900a.)

t°.	Gms. Na_2WO_4 per 100 Gms. Solution.	Mols. Na_2WO_4 per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. Na_2WO_4 per 100 Gms. Solution.	Mols. Na_2WO_4 per 100 Mols. H_2O.	Solid Phase.
−5	30.60	2.70	$Na_2WO_4.10H_2O$	−3.5	41.67	4.37	$Na_2WO_4.2H_2O$
−4	31.87	2.86	"	+0.5	41.73	4.39	"
−3.5	32.98	3.01	"	18	42.0	4.40	"
−2	34.52	3.23	"	21	42.27	4.48	"
0	36.54	3.52	"	43.5	43.98	4.81	"
+3	39.20	3.95	"	80.5	47.65	5.57	"
5	41.02	4.26	"	100	49.31	5.95	"

Sp. Gr. of sat. solution at 18° = 1.573. For Sp. Gr. determinations of aqueous solutions at 20°, see Pawlewski, 1900.

Fusion-point data for Na_2WO_4 + WO_3 are given by Parravano (1909).

SODIUM URATE $C_5H_3N_4O_3.Na$.

SOLUBILITY IN AQUEOUS SODIUM CHLORIDE AT 37°.

(d'Agostino, 1910.)

Gms. Mols. per Liter.		Gms. Mols. per Liter.		Gms. Mols. per Liter.	
NaCl.	$C_5H_3N_4O_3.Na$.	NaCl.	$C_5H_3N_4O_3Na$.	NaCl.	$C_5H_3N_4O_3$ Na.
0	0.00536	0.01084	0.00211	0.05116	0.00050
0.00486	0.00340	0.01398	0.00172	0.06667	0.00034
0.00532	0.00321	0.02564	0.00102	0.07363	0.00032
0.00865	0.00256	0.04012	0.00054	0.08595	0.00026

One liter of H_2O dissolves 1.5 gms. sodium urate at 37°. (Bechhold and Ziegler, 1910.)
One liter of serum dissolves 0.025 gm. sodium urate at 37°. " "

SODIUM MetaVANADATE $NaVO_3$.

SOLUBILITY IN WATER.

(MacAdam and Pierle, 1912.)

t°.	Gms. $NaVO_3$ per 100 Gms H_2O.	Solid Phase.	t°.	Gms. $NaVO_3$ per 100 Gms H_2O.	Solid Phase.
25	21.10	$NaVO_3$	25	15 3	$NaVO_3.2H_2O$
40	26.23	"	40	30 2	"
60	32.97	"	60	68.4	"
75	38.83	"	75	38.8	$NaVO_3$

Considerable time was required for attainment of equilibrium. The two solid phases appear to exist for the whole rage of temperature and the conditions for the transformation of one into the other were not ascertained.

SODIUM FluoZIRCONATE $5NaF.ZrF_4$.

100 gms. H_2O dissolve 0.387 gm. at 18°, and 1.67 gms. at 100°. (Marignac, 1861.)

SPARTEINE $C_{15}H_{26}N_2$.

SOLUBILITY IN WATER AND IN AQUEOUS SODIUM CARBONATE SOLUTIONS.

(Valeur, 1917)

The author prepared solutions of recently distilled colorless sparteine (α = −2°.46′ in 5 cm. tube) in aqueous 5 per cent Na_2CO_3 and determined the temperature at which clouding occurred in each.

t° of Clouding.	Gms. $C_{15}H_{26}N_2$ per 100 cc.	t° of Clouding.	Gms $C_{15}H_{26}N_2$ per 100 cc.	t° of Clouding.	Gms. $C_{15}H_{26}N_2$ per 100 cc.
23.4	2 1	33.5	1.5	47	0.9
24	1 95	36.5	1.35	53	0.75
25	1 8	39 8	1.2	60.2	0.60
28.6	1.65	43.5	1.05	72.5	0.45

A saturated solution of sparteine in water was prepared, and after removing the solid phase by centrifugation, the amount of sparteine in the saturated solution was determined with the aid of the data in the above table. Enough Na_2CO_3 and H_2O to yield 5 per cent Na_2CO_3 were added and the temperature of clouding observed and compared with the above results. The average of these determinations was 0.556 gm. sparteine per 100 cc. sat. solution in water at 10.8°.

SPARTEINE SULFATE $C_{15}H_{26}N_2.H_2SO_4.5H_2O$.

100 gms. H_2O dissolve about 200 gms. sparteine sulfate at 15–20°.
100 cc. 90% alcohol dissolve about 20 gms. sparteine sulfate at 15–20°.
(Squire and Caines, 1905.)

STEARIC ACID $CH_3(CH_2)_{16}COOH$.

100 gms. H_2O dissolve 0.1 gm. stearic acid at 37°.
100 gms. 5% aqueous solution of bile salts dissolve less than 0.1 gm. stearic acid.
100 gms. 5% aq. sol. of bile salt + 1% lecithin dissolve 0.2 gm. stearic acid.
In the same solvents there is dissolved of sodium stearate, 0.1, 0.2 and 0.7 gm. respectively. (Moore, Wilson and Hutchinson, 1909.)

SOLUBILITY OF STEARIC ACID IN AQUEOUS ETHYL ALCOHOL AT 25°.

(Seidell, 1910)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_{17}H_{35}COOH$ per 100 Gms. Sat. Sol.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_{17}H_{35}COOH$ per 100 Gms. Sat. Sol.
0	0.999	0.034	70	0.865	0.80
20	0.967	0.04	80	0.841	1.63
40	0.932	0.10	90	0.818	3.30
50	0.911	0.18	95	0.807	5.55
60	0.888	0.40	100	0.795	8.30

100 cc. sat. sol. in 94.3 Vol. % C_2H_5OH contain 0.0996 gm. $C_{17}H_{35}COOH$ at 0° (d_0 = 0.8318).
100 cc. sat. sol. in 95.1 " " " contain 0.1139 " " " (d_0 = 0.8287).
100 cc. sat. sol. in 95.7 " " " contain 0.1246 " " " (d_0 = 0.8265).

Saturation was approached from above without constant agitation. (Emerson, 1907.)

SOLUBILITY OF STEARIC ACID IN ETHYL ALCOHOL AT SEVERAL TEMPERATURES.

(Falciola, 1910)

t°.	Gms. $C_{17}H_{35}COOH$ per 100 cc of: Absolute Alcohol.	75% Alcohol.	50% Alcohol
10	0.9	0.15	...
20	2	...	0.08 (23°)
30	4.5	0.39	0.10
40	13.8	0.77	0.12

100 cc. sat. solution in 94.4 Vol. % CH_3OH ("methylated alcohol" of d = 0.8183) contain 0.15 gm. $C_{17}H_{35}COOH$ at +0.2°. Saturation was approached from above without constant agitation. (Hehner and Mitchell, 1897.)

SOLUBILITY OF STEARIC ACID IN SEVERAL SOLVENTS AT 25°.

(Seidell, 1910)

Solvent.	d of Solvent.	d_{25} of Sat. Sol.	Gms. $C_{17}H_{35}COOH$ per 100 Gms. Sat. Sol.
Acetone	d_{15} = 0.797	0.815	4.73
Amyl Alcohol (iso)	d_{20} = 0.817	0.815	9.43
Amyl Acetate	d_{20} = 0.875	0.867	11.19
Carbon Disulfide	d_{25} = 1.259	1.163	19.20
Carbon Tetrachloride	d_{25} = 1.587	1.465	10.25
Chloroform	d_{22} = 1.476	1.332	15.54
Ether (abs.)	d_{22} = 0.711	0.744	20.04
Ethyl Acetate	d_{25} = 0.892	0.895	7.36
Nitrobenzene	d_{25} = 1.205	1.199	1.24
Toluene	d_{15} = 0.872	0.865	13.61

Fusion-point data for stearic acid + tristearin and for stearic acid + tristearin + palmitic acid are given by Kremann and Kropsch (1914).

STILBENE $C_6H_5CH:CH.C_6H_5$.

Freezing-point data for mixtures of stilbene and p dimethoxystilbene are given by Pascal and Normand (1913).

STRONTIUM ACETATE $Sr(CH_3COO)_2.\frac{1}{2}H_2O$.

SOLUBILITY IN WATER.

(Osaka and Abe, 1911)

t°.	Gms. $Sr(CH_3COO)_2$ per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. $Sr(CH_3COO)_2$ per 100 Gms H_2O.	Solid Phase.
0.05	36.93	$Sr(CH_3COO)_2.4H_2O$	25	40.19	$Sr(CH_3COO)_2.\frac{1}{2}H_2O$
5	39.91	"	35.03	38.82	"
10	43.61	"	50	37.35	"
8.4 tr. pt.	43.1	" $+Sr(CH_3COO)_2.\frac{1}{2}H_2O$	70	36.24	"
8	43.5	$Sr(CH_3COO)_2.\frac{1}{2}H_2O$	80	36.10	"
10	42.95	"	90	36.24	"
15	41.90	"	97	36.36	"

STRONTIUM BENZOATE $Sr(C_7H_5O_2)_2.H_2O$.

SOLUBILITY IN WATER.
(Pajetta, 1906.)

t°.	15.7°.	24.7°.	31.4°.	40.9°.
Gms. $Sr(C_7H_5O_2)_2$ per 100 Gms. Solution	5.31	5.4	5.56	5.77

STRONTIUM BROMATE $Sr(BrO_3)_2$.

One liter of aqueous solution contains 0.9 gm. molecules or 309 gms. $Sr(BrO_3)_2$ at 18°. (Kohlrausch, 1897.)

STRONTIUM BROMIDE $SrBr_2.6H_2O$.

SOLUBILITY IN WATER.
(Average curve from results of Kremers, 1858; and Etard, 1894.)

t°.	Gms. $SrBr_2$ per 100 Gms. Solution.	Gms. $SrBr_2$ per 100 Gms. Water.	t°.	Gms. $SrBr_2$ per 100 Gms. Solution.	Gms. $SrBr_2$ per 100 Gms. Water.
0	46	85.2	40	55.2	123.2
10	48.3	93	50	57.6	135.8
20	50.6	102.4	60	60	150
25	51.7	107	80	64.5	181.8
30	52.8	111.9	100	69	222.5

Sp. Gr. of sat. solution at 20° approximately 1.70.
100 gms. abs. alcohol dissolve 64.5 gms. $SrBr_2$ at 0°. Sp. Gr. of solution = 1.21. (Fonzes-Diacon, 1895.)

SOLUBILITY OF STRONTIUM BROMIDE IN AQUEOUS SOLUTIONS OF STRONTIUM NITRATE AT 25°.
(Harkins and Pearce, 1916.)

Mols. per 1000 Gms. H_2O. $Sr(NO_3)_2$.	Mols. per 1000 Gms. H_2O. $SrBr_2$.	Gms. $SrBr_2$ per 1000 Gms. H_2O.	$d_{25/4}$ of Sat. Sol.	Mols. per 1000 Gms. H_2O. $Sr(NO_3)_2$.	Mols. per 1000 Gms. H_2O. $SrBr_2$.	Gms. $SrBr_2$ per 1000 Gms. H_2O.	$d_{25/4}$ of Sat. Sol.
0	4.3080	1066.1	1.7002	0.30663	4.3180	1068.8	1.73766
0.036	4.3105	1066.95	...	0.61124	4.3190	1069.17	1.74866
0.07216	4.3125	1067.42	1.70325	1.8610	4.3390	1073.97	1.77368
0.14568	4.3170	1068.54	1.72844				

Data for equilibrium in the system strontium bromide, strontium oxide and water at 25° are given by Milikau (1916).

STRONTIUM CAMPHORATE *d* $C_{10}H_{14}O_4Sr.4H_2O$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF CAMPHORIC ACID AT 16–17°.
(Jungfleisch and Landrieu, 1914)

Gms. per 100 Gms. Sat. Sol. $C_8H_{14}(COOH)_2$.	Gms. per 100 Gms. Sat. Sol. $C_{10}H_{14}O_4Sr$.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. $C_8H_{14}(COOH)_2$.	Gms. per 100 Gms. Sat. Sol. $C_{10}H_{14}O_4Sr$.	Solid Phase.
1.25	1.413	$C_8H_{14}(COOH)_2$	1.20	17.99	$(C_{10}H_{15}O_4)_2Sr(C_{10}H_{16}O_4)_2$
1.03	1.7705	$(C_{10}H_{15}O_4)_2Sr(C_{10}H_{16}O_4)_2$	0	16.95	$C_{10}H_{14}O_4Sr.4H_2O$
1.13	6.525	"	0	16.56	"
1.20	12.452		0	12.86 (at 98°)	"

STRONTIUM CARBONATE $SrCO_3$.

One liter of water dissolves 0.00082 gm. at 8.8° and 0.0109 gm. at 24° by conductivity method. (Holleman, 1893; Kohlrausch and Rose, 1893.)
One liter of water saturated with CO_2 dissolves 1.19 gms. $Sr(HCO_3)_2$.

Data for the solubility of strontium carbonate in water containing CO_2 at pressures between 0.05 and 1.1 atmospheres are given by McCoy and Smith (1911). The equilibrium constant is $k = 1.29 \times 10^{-2}$ with an average deviation from the mean of 1.2 per cent. From this value, the solubility product is calculated to be $Sr \times CO_3 = k_3 = 1.567 \times 10^{-9}$.

Solubility of Strontium Carbonate in Aqueous Ammonium Chloride.

(Cantoni and Goguelia, 1905.)

Gms. NH_4Cl per 100 Gms. Solution.	Gms. $SrCO_3$ per 1000 cc. Sat. Solution.
5.35	0.179
10	0.259
20	0.358

The mixtures were allowed to stand at 12–18° for 98 days.
Fusion-point data for $SrCO_3 + SrCl_2$ are given by Sackur (1911–12).

STRONTIUM CHLORATE $Sr(ClO_3)_2$.

100 gms. H_2O dissolve 174.9 gms. $Sr(ClO)_2$, or 100 gms. sat. solution contain 63.6 gms. at 18°. Sp. Gr. of solution is 1.839. (Mylius and Funk, 1897.)

STRONTIUM CHLORIDE $SrCl_2.6H_2O$.

Solubility in Water.

(Average curve from the results of Mulder; Etard; see also Tilden, 1884.)

t°.	Gms. $SrCl_2$ per 100 Gms. Solution.	Gms. $SrCl_2$ per 100 Gms. Water.	Solid Phase.	t°.	Gms. $SrCl_2$ per 100 Gms. Solution.	Gms. $SrCl_2$ per 100 Gms. Water.	Solid Phase.
−20	26.0	35.1	$SrCl_2.6H_2O$	60	45.0	81.8	$SrCl_2.6H_2O$
0	30.3	43.5	"	70	46.2	85.9	$SrCl_2.2H_2O$
10	32.3	47.7	"	80	47.5	90.5	"
20	34.6	52.9	"	100	50.2	100.8	"
25	35.8	55.8	"	120	53.0	112.8	"
30	37.0	58.7	"	140	55.6	125.2	"
40	39.5	65.3	"	160	58.5	141.0	"
50	42.0	72.4	"	180	62.0	163.1	"

Transition temperature about 62.5°. Sp. Gr. of sat. solution at 0° = 1.334; at 15° = 1.36.

Solubility of Strontium Chloride in Aqueous Solutions of Hydrochloric Acid at 0°. (Engel, 1888.)

Mg. Mols. per 10 cc. Solution. $\frac{1}{2}SrCl_2$.	Mg. Mols. per 10 cc. Solution. HCl.	Sp. Gr. of Solution.	Grams per 100 cc. Solution. $SrCl_2$.	Grams per 100 cc. Solution. HCl.
51.6	0	1.334	40.9	0.0
44.8	6.1	1.304	35.5	2.22
37.85	12.75	1.269	30.0	4.65
27.2	23.3	1.220	21.56	8.49
22.0	28.38	1.201	17.44	10.35
14.0	37.25	1.167	11.09	13.58
4.25	52.75	1.133	3.37	19.23

Solubility of Strontium Chloride in Aqueous Solutions of Hydrobromic and of Hydrochloric Acids at 25°.

(Harkins and Paine, 1916.)

In Aqueous HBr. Gms. Equiv. HBr per 1000 Gms. H_2O.	d_{25} of Sat. Sol.	Gms. $SrCl_2$ per 100 Gms. Sat. Sol.	In Aqueous HCl. Gms. Equiv. HCl per 1000 Gms. H_2O.	d_{25} of Sat. Sol.	Gms. $SrCl_2$ per 100 Gms. Sat. Sol.
0	1.4015	35.80	0.1551	1.3953	35.17
0.06817	1.4020	35.47	0.5162	1.3788	33.60
0.4191	1.4010	33.92	1.017	1.3563	31.42
0.9716	1.3992	31.52	2.165	1.3065	26.33
1.154	1.3995	20.78	9.205	1.1498	3.055

SOLUBILITY OF STRONTIUM CHLORIDE IN AQUEOUS SOLUTIONS OF ACIDS AND OF SALTS AT 25°.

(Harkins and Paine, 1916.)

Aqueous Solution of:	Gms. Equiv. added Salt per 1000 Gms. H_2O.	d_{25} of Sat. Sol.	Gms. $SrCl_2$ per 100 Gms. Sat. Sol.	Aqueous Solution of:	Gms. Equiv. added Salt per 1000 Gms. H_2O.	d_{25} of Sat. Sol.	Gms. $SrCl_2$ per 100 Gms. Sat. Sol.
$CuCl_2$	0.7134	1.4200	34.005	KNO_3	0.09796	1.4107	35.86
"	2.276	1.4595	30.40	"	0.4755	1.4349	35.90
HI	0.1641	1.4058	34.850	HNO_3	0.1771	1.4038	35.52
"	0.4462	1.4121	33.28	"	0.3521	1.4059	35.40
"	0.7539	1.4196	31.52	"	1.277	1.4175	34.04
KI	0.09199	1.4093	35.45	$NaNO_3$	0.3621	1.4216	35.63
"	0.5401	1.4466	33.79	"	0.5010	1.4588	35.60
"	0.6015	1.4513	33.60	"	3.553	1.5214	30.88
"	1.445	1.5154	30.90	"	6.856	1.5581	25.53
KCl	0.0719	1.4032	35.62	$Sr(NO_3)_2$	0.1372	1.4113	35.42
"	0.433	1.4085	34.80	"	0.5766	1.4336	34.47
"	0.8576	1.4152	33.89	"	1.0988	1.4636	33.30
"	1.594	1.4266	32.40	"	3.318	1.6664	28.97

Data for equilibrium in the system strontium chloride, strontium oxide and water at 0°, 25° and 40° are given by Milikau (1916).

100 gms. abs. methyl alcohol dissolve 63.3 gms. $SrCl_2.6H_2O$ at 6°.

100 gms. abs. ethyl alcohol dissolve 3.8 gms. $SrCl_2.6H_2O$ at 6°. (de Bruyn, 1892.)

SOLUBILITY OF STRONTIUM CHLORIDE IN AQUEOUS ETHYL ALCOHOL SOLUTIONS AT 18°.

(Gerardin, 1865.)

Sp. Gr. of Aq. Alcohol at 0°.	Wt. per cent Alcohol.	Gms. $SrCl_2$ per 100 Gms. Alcohol.	Sp. Gr. of Aq. Alcohol at 0°.	Wt. per cent Alcohol.	Gms. $SrCl_2$ per 100 Gms. Alcohol.
0.990	6	49.81	0.939	45	26.8
0.985	10	47.0	0.909	59	19.2
0.973	23	39.6	0.846	86	4.9
0.966	30	35.9	0.832	91	3.2
0.953	38	30.4			

100 gms. 95% formic acid dissolve 23.8 gms. $SrCl_2$ at 19°. (Aschan, 1913.)

100 cc. anhydrous hydrazine dissolve 8 gms. $SrCl_2$ at room temp. (Welsh and Broderson, 1915.)

Fusion-point data for $SrCl_2 + SrF_2$ are given by Plato (1907). Results for $SrCl_2 + SrO$ and $SrCl_2 + SrSO_4$ by Sackur (1911–12). Results for $SrCl_2 + TlCl$ by Korreng (1914) and results for $SrCl_2 + ZnCl_2$ by Sandonnini (1912a, 1914).

STRONTIUM CHROMATE $SrCrO_4$.

SOLUBILITY IN WATER, ETC., AT 15°.

(Fresenius, 1891.)

Solvent.	Gms. $SrCrO_4$ per 100 Gms Solvent.	Solvent.	Gms. $SrCrO_4$ per 100 Gms. Solvent.
Water	0.12	Aq. Ethyl Alcohol (29%)	0.0132
Aq. NH_4Cl (5%)	0.195	Aq. Ethyl Alcohol (53%)	0.002
Aq. CH_3COOH (1%)	1.57		

STRONTIUM CINNAMATE $(C_6H_5CH:CH.COO)_2Sr.2H_2O$.

100 gms. H_2O dissolve 1 gm. $(C_6H_5CH:CH.COO)_2Sr$ at 15°-20°. (Squire and Caines, 1905.)

100 gms. sat. aqueous solution contain 1.18 gm. $(C_6H_5CH:CH.COO)_2Sr$ at 15° and 3.11 gms. at 100°. (Tarugi and Checchi, 1901.)

STRONTIUM FORMATE $Sr(HCOO)_2.2H_2O$.

SOLUBILITY IN WATER. (Stanley, 1904)

t°.	Gms. $Sr(HCOO)_2$ per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. $Sr(HCOO)_2$ per 100 Gms. H_2O.	Solid Phase.
0	7 02 (8.35)	$Sr(HCOO)_2.2H_2O$	67 5	20.62 (21 76)	$Sr(HCOO)_2.2H_2O$
11	8.08 (9.54)	"	81.5	26.14 (26.36)	"
28.6	11 62 (13.25)	"	86	27 58 (27.57)	$Sr(HCOO)_2.H_2O$
37.4	13.01 (14.68)	"	91.7	27.01 (27 07)	"
51.4	16 31 (17.83)	"	100	26 57 (26.72)	"

There appears to be an error in the calculation of the results as given by the author in his table. The figures given above in parentheses have, therefore, been calculated from the weights of $SrSO_4$ recorded in the original table and show the weight of $Sr(HCOO)_2$ per 100 gms. of saturated solution.

STRONTIUM FLUORIDE SrF_2.

One liter of water dissolves 0.1135 gm. SrF_2 at 0.26°, 0.1173 gm. at 17.4° and 0.1193 gm. at 27.4°, determined by the conductivity method. (Kohlrausch, 1908)

STRONTIUM GLYCEROPHOSPHATE $C_3H_7O_2PO_4Sr.2H_2O$.

100 gms. sat. solution in water contain 2.09 gms. anhydrous salt at 18° and 0.8 gm. at 60°. (Rogier and Fiore, 1913)

STRONTIUM HYDROXIDE $Sr(OH)_2.8H_2O$.

SOLUBILITY IN WATER. (Scheibler, 1883)

t°.	Grams per 100 Grams Solution.		Grams per 100 cc. Solution.	
	SrO.	$Sr(OH)_2.8H_2O$.	SrO.	$Sr(OH)_2.8H_2O$.
0	0 35	0.90	0 35	0.90
10	0.48	1 23	0 48	1 23
20	0 68	1 74	0.68	1.74
30	1 00	2.57	1 01	2 59
40	1.48	3 80	1.51	3 87
50	2.13	5 46	2.18	5 59
60	3.03	7 77	3.12	8.00
70	4 35	11 16	4 55	11 67
80	6.56	16 83	7 02	18.01
90	12.0	30 78	13.64	34 99
100	18.6	47 71	22.85	58.61

MUTUAL SOLUBILITY OF STRONTIUM HYDROXIDE AND STRONTIUM NITRATE IN WATER AT 25°. (Parsons and Perkins, 1910)

d_{25} of Sat. Sol.	Gms per 100 Gms H_2O. SrO as $Sr(OH)_2$.	$Sr(NO_3)_2$.	Solid Phase.	d_{25} of Sat. Sol.	Gms. per 100 Gms H_2O. SrO as $Sr(OH)_2$.	$Sr(NO_3)_2$.	Solid Phase.
1.481	0	79.27	$Sr(NO_3)_2$	1.267	1.11	37.81	$Sr(OH)_2.8H_2O$
1.492	0.38	79.47	"	1.217	1.01	28.80	"
1.494	0.78	80.83	"	1.178	0.95	23.83	"
1.506	1.76	81.06	$Sr(OH)_2.8H_2O$	1.148	0.91	17.96	"
1.490	1.71	74.27	"	1.108	0.84	12.78	"
1.419	1.51	63.71	"	1.079	0.81	8.96	"
1.381	1.41	56.30	"	1.059	0.79	6.29	"
1.327	1.27	46.97	"	1.033	0.78	4.45	"

SOLUBILITY OF STRONTIUM HYDROXIDE IN AQUEOUS SOLUTIONS AT 25°.

(Rothmund, 1910.)

Aqueous Solution of:	Mols. $Sr(OH)_2.8H_2O$ per Liter.	Gms. $Sr(OH)_2$ per Liter.	Aqueous Solution of:	Mols. $Sr(OH)_2.8H_2O$ per Liter.	Gms. $Sr(OH)_2$ per Liter.
Water alone	0.0835	10.16	0.5 *n* Glycol	0.0922	11.21
0.5 *n* Methyl Alcohol	0.0820	9.97	" Glycerol	0.1094	13.31
" Ethyl Alcohol	0.0744	9.05	" Mannitol	0.1996	24.29
" Propyl Alcohol	0.0708	8.61	" Urea	0.0820	9.97
" Amyl Alcohol (tertiary)	0.0630	7.66	" Ammonia	0.0785	9.55
" Acetone	0.0692	8.42	" Dimethylamine	0.0586	7.13
" Ether	0.0645	7.85	" Pyridine	0.0694	8.44

Data for equilibrium in the system strontium hydroxide, phenol and water at 25° are given by van Meurs (1916).

STRONTIUM IODATE $Sr(IO_3)_2$.

100 gms. H_2O dissolve 0.026 gm. at 15°, and 0.72–0.91 gm. at 100°.
(Gay-Lussac; Rammelsberg, 1838.)

STRONTIUM IODIDE $SrI_2.6H_2O$.

SOLUBILITY IN WATER.

(Average curve from the results of Kremers, 1858, and Etard, 1874.)

t°.	Gms. SrI_2 per 100 Gms. Solution.	Gms. SrI_2 per 100 Gms. Water.	Solid Phase.	t°.	Gms. SrI_2 per 100 Gms. Solution.	Gms. SrI_2 per 100 Gms. Water.	Solid Phase.
0	62.3	165.3	$SrI_2.6H_2O$	90	78.5	365.2	$SrI_2.2H_2O$
20	64.0	177.8	"	100	79.3	383.1	"
40	65.7	191.5	"	120	80.7	418.1	"
60	68.5	217.5	"	140	82.5	471.5	"
80	73.0	270.4	"	175	85.6	594.4	"

Transition temperature about 90°. Sp. Gr. of sat. solution at 20° = 2.15

100 gms. sat. solution of strontium iodide in absolute alcohol contain 2.6 gms. SrI_2 at −20°, 3.1 gms. at +4°, 4.3 gms. at 39°, and 4.7 gms. at 82°. (Etard, 1874.)

Data for equilibrium in the system strontium iodide, strontium oxide and water at 25° are given by Milikau (1916).

STRONTIUM PerIODIDE SrI_4.

Data for the formation of strontium periodide in aqueous solution at 25° are given by Herz and Bulla (1911). The experiments were made by adding iodine to aqueous solutions of SrI_2 and agitating with carbon tetrachloride. From the iodine content of the CCl_4 layer the amount of iodine in the aqueous layer can be calculated on the basis of the distribution ratio of iodine between water and CCl_4. This furnishes the necessary data for calculating the amount of the strontium periodide existing in the aqueous layer.

STRONTIUM IODOMERCURATE $SrI_2.HgI_2.8H_2O$.

A saturated aqueous solution prepared by adding SrI_2 and HgI_2 in excess to warm water and filtering when the temperature had fallen to 16.5° was found to have the composition 1.0 SrI_2.1.24 HgI_2.18.09 H_2O. The $d_{16.5}$ was 2.5
(Duboin, 1906.)

STRONTIUM MALATE $SrC_4H_4O_5$.

SOLUBILITY IN WATER.
(Cantoni and Basadonna, 1906.)

t°.	Gms. per 100 cc. Solution.	t°.	Gms. per 100 cc. Solution.	t°.	Gms. per 100 cc. Solution.
20	0.448	40	1.385	55	2.460
25	0.550	45	1.743	60	2.821
30	0.752	50	2.098	65	3.148
35	1.036			70	3.360

STRONTIUM MALONATE $CH_2(COO)_2Sr$.

SOLUBILITY IN WATER.
(Cantoni and Diotalevi, 1905.)

t°.	Gms. per 100 cc. Sat. Sol.	t°.	Gms. per 100 cc. Sat. Sol.	t°.	Gms. per 100 cc. Sat. Sol.
0	0.541	25	0.521	40	0.464
10	0.540	30	0.499	45	0.453
20	0.532	35	0.478	50	0.443

STRONTIUM MOLYBDATE $SrMoO_4$.

100 gms. H_2O dissolve 0.0104 gm. $SrMoO_4$ at 17°. (Smith and Bradbury, 1891.)

STRONTIUM NITRATE $Sr(NO_3)_2$.

SOLUBILITY IN WATER.
(Berkeley and Appleby, 1911.)

t°.	d_t of Sat. Sol.	Gms. $Sr(NO_3)_2$ per 100 Gms H_2O	Solid Phase.	t°.	d_t of Sat. Sol.	Gms. $Sr(NO_3)_2$ per 100 Gms H_2O.	Solid Phase.
0.58	1.28561	40.124	$Sr(NO_3)_2.4H_2O$	30.74	1.51282	90.086	$Sr(NO_3)_2$
14.71	1.39380	60.867	"	47.73	1.51150	91.446	"
26.40	1.48831	82.052	"	61.34	1.51048	93.856	"
29.06	1.51098	87.648	"	68.96	1.51057	95.576	"
29.3*	...	...	" $+Sr(NO_3)_2$	78.98	1.51091	97.865	"
30.28	1.51441	88.577	$Sr(NO_3)_2$	88.94	1.51174	100.136	"
32.58	1.51408	88.943	"				

The determinations were made with very great accuracy.

SOLUBILITY OF STRONTIUM NITRATE IN AQUEOUS ALCOHOL AT 25°.
(D'Ans and Siegler, 1913.)

Wt. % C_2H_5OH in Solvent.	Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	Gms. per 100 Gms. Sat. Sol. $Sr(NO_3)_2$.	Solid Phase.	Wt. % C_2H_5OH in Solvent.	Gms. per 100 Gms. Sat. Sol. C_2H_5OH.	Gms. per 100 Gms. Sat. Sol. $Sr(NO_3)_2$.	Solid Phase.
0	0	44.25	$Sr(NO_3)_2.4H_2O$	10	6	40.05	$Sr(NO_3)_2$ (unstable)
4	1.7	42.8	"	15.05	9.5	36.7	" (unstable)
6	2.6	42.1	"	18.8*	12.35	34.3	" $+Sr(NO_3)_2.4H_2O$
10.8	4.95	40.4	"	20.6	13.8	33.2	$Sr(NO_3)_2$
16	7.95	37.6	"	40.65	32.35	20.5	"
20*	12.35	34.3	" $+Sr(NO_3)_2$	59.9	53.6	10.5	"
0	0	46.6	$Sr(NO_3)_2$ (unstable)	79.2	77.15	2.6	"
6	3.45	42.7	" "	99.4	99.38	0.02	"

* Tr pt.

100 cc. anhydrous hydrazine dissolve 5 gms. $Sr(NO_3)_2$ at room temp. (Welsh and Broderson, 1915.)

STRONTIUM NITRITE $Sr(NO_2)_2.H_2O$.

100 cc. sat. solution in water contain 62.83 gms. $Sr(NO_2)_2.H_2O$ at 19.5°.
" " " " 90% alcohol " 0.42 " " " 20°.
" " " " abs. alcohol " 0.04 " " " 20°.

(Vogel, 1903.)

SOLUBILITY OF STRONTIUM NITRITE IN WATER.
(Oswald, 1912, 1914.)

t°.	Gms. $Sr(NO_2)_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $Sr(NO_2)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
− 1.3	11.3	Ice	35	43.1	$Sr(NO_2)_2.H_2O$
− 3.1	19.6	"	52.5	46.5	"
− 7.7	35.5	"	60.5	49.3	"
− 6.8	32.8	" + $Sr(NO_2)_2.H_2O$	65.5	50.7	"
− 2.3	33.4	$Sr(NO_2)_2.H_2O$	82.5	54	"
− 0.3	34.5	"	92	56.6	"
+19	39.3*	"	98	58.1	"

* $d = 1.4461$.

STRONTIUM OXALATE $SrC_2O_4.H_2O$.

One liter of water dissolves 0.0328 gm. SrC_2O_4 at 1.35°, 0.0444 gm. at 15.9°, 0.0461 gm. at 18°, 0.0575 gm. at 31.7° and 0.0617 gm. at 37.3°, determined by the conductivity method. (Kohlrausch, 1908.)

One liter of sat. aqueous solution contains 0.057 gm. SrC_2O_4 at 0°, 0.077 gm. at 20° and 0.093 gm. at 40°. (Cantoni and Diotalevi, 1905.)

SOLUBILITY OF STRONTIUM OXALATE IN AQUEOUS ACETIC ACID SOLUTIONS AT 26°–27°.
(Herz and Muhs, 1903.)

Normality of Acetic Acid.	Gms. per 100 cc Solution. CH_3COOH	Gms. per 100 cc Solution. $SrC_2O_4.H_2O$.	Normality of Acetic Acid.	Gms. per 100 cc Solution. CH_3COOH.	Gms. per 100 cc Solution. $SrC_2O_4.H_2O$.
0	0	0.009	3.86	23.16	0.0598
0.58	3.48	0.0526	5.79	34.74	0.0496
1.45	8.70	0.0622	16.26	97.56	0.0060
2.89	17.34	0.0642			

STRONTIUM OXIDE SrO.

Fused $SrCl_2$ dissolves 18.3 gms. SrO per 100 gms. of the fused melt at 910°. (Arndt., 1907.)

STRONTIUM PERMANGANATE $Sr(MnO_4)_2$.

100 gms. of the sat. solution in water contain about 2.5 gms. $Sr(MnO_4)_2$ at 0°. (Patterson, 1906.)

STRONTIUM SALICYLATE $(C_6H_4OH.COO)_2Sr.2H_2O$.

100 gms. sat. solution in water contain 3.04 gms. $(C_6H_4OHCOO)_2Sr$ at 15° and 20.44 gms. at 100°. (Tarugi and Checchi, 1901.)

SOLUBILITY OF STRONTIUM SALICYLATE IN AQUEOUS ALCOHOL AT 25°.
(Seidell, 1909, 1910.)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $(C_6H_4OH.COO)_2Sr.2H_2O$ per 100 Gms. Sat. Sol.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $(C_6H_4OH.COO)_2Sr.2H_2O$ per 100 Gms. Sat. Sol.
0	1.022	5.04	60	0.923	7.15
10	1.006	4.88	70	0.893	5.90
20	0.993	5.22	80	0.859	4.40
30	0.982	6.20	90	0.824	2.56
40	0.966	7.70	92.3	0.815	2.02
50	0.948	8.08	100	0.790	0.44

The solid phase was $(C_6H_4OH.COO)_2Sr.2H_2O$ in all cases except the solution in 100 per cent alcohol, in which partial dehydration and conversion of the crystalline salt to an amorphous bulky white powder occurred.

STRONTIUM SUCCINATE $C_4H_4O_4Sr$.

100 gms. sat. solution in water contain 0.439 gm. $C_4H_4O_4Sr$ at 15° and 0.215 gm. at 100°. (Tarugi and Checchi, 1901.)

SOLUBILITY OF STRONTIUM SUCCINATE IN WATER.
(Cantoni and Diotalevi, 1905.)

t°.	Gms. $C_4H_4O_4Sr$ per 100 cc. Sat. Sol.	t°.	Gms. $C_4H_4O_4Sr$ per 100 cc. Sat. Sol.	t°.	Gms. $C_4H_4O_4Sr$ per 100 cc. Sat. Sol.
0	0.052	20	0.270	40	0.375
5	0.076	25	0.382	45	0.389
10	0.111	30	0.451	50	0.424
15	0.177	35	0.413		

STRONTIUM SULFATE $SrSO_4$.

One liter of water dissolves 0.1133 gm. $SrSO_4$ at 2.85°, 0.1143 gm. at 17.4° and 0.1143 gm. at 32.3°, determined by the conductivity method. (Kohlrausch, 1908.)

SOLUBILITY OF STRONTIUM SULFATE IN AQUEOUS SOLUTIONS OF AMMONIUM ACETATE AT 25°.
(Marden, 1916)

Gms per 100 Gms. Sat. Sol. CH_3COONH_4.	Gms per 100 Gms. Sat. Sol. $SrSO_4$.	Gms per 100 Gms. Sat. Sol. CH_3COONH_4.	Gms per 100 Gms. Sat. Sol. $SrSO_4$.
0	0.0151	10.68	0 0942
2.13	0.0451	21.37	0.115
5.34	0.0732		

SOLUBILITY OF STRONTIUM SULFATE IN AQUEOUS CALCIUM NITRATE AT ROOM TEMPERATURE
(Raffo and Rossi, 1915)

Analyzed solutions of $Sr(NO_3)_2$, $Ca(NO_3)_2$ and $CaSO_4$ were mixed at 60° and allowed to stand at room temperature 1 to 2 days. The resulting $SrSO_4$ was determined and the difference between the amount found and the amount which would have resulted if all the $Sr(NO_3)_2$ had been converted to $SrSO_4$, was taken as the amount of $SrSO_4$ dissolved. Gradually increasing concentrations of $Ca(NO_3)_2$ were used.

Gms. per 100 cc Sat Sol $Ca(NO_3)_2$.	Gms. per 100 cc Sat Sol $SrSO_4$.	Gms per 100 cc Sat Sol. $Ca(NO_3)_2$.	Gms per 100 cc Sat Sol. $SrSO_4$.
0.5	0.0483	4	0.1489
1	0.0619	5	0.1698
2	0.1081	6	0.1955
3	0.1275		

SOLUBILITY OF STRONTIUM SULFATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC, NITRIC, CHLORACETIC AND FORMIC ACIDS.
(Banthisch, 1884.)

cc. of Aq. Acid containing 1 Mg. Equiv. in each case.	In Aq. HCl Gms. per 100 cc. Sol. HCl.	In Aq. HCl Gms. per 100 cc. Sol. $SrSO_4$.	In Aq. HNO_3 Gms. per 100 cc. Sol. HNO_3.	In Aq. HNO_3 Gms. per 100 cc. Sol. $SrSO_4$.	In Aq. $CH_2ClCOOH$ Gms. per 100 cc Sol. CH_2Cl COOH.	In Aq. $CH_2ClCOOH$ Gms. per 100 cc Sol. $SrSO_4$.	In Aq. HCOOH Gms. per 100 cc. Sol. HCOOH.	In Aq. HCOOH Gms. per 100 cc. Sol. $SrSO_4$.
0.2	18.23	0.161	31.52	0.381	...	...	...	...
0.5	7.29	0.207	12.61	0.307	...	...	...	...
1.0	3.65	0.188	6.30	0.217	94.47	0.026	46.02	0.024
2.0	1.82	0.126	3.15	0.138	47.23	0.022	...	...
10.0	0.36	0.048	0.63	0.049	...	...	...	...

100 gms. 95 per cent formic acid dissolve 0.02 gm. $SrSO_4$ at 18.5°. (Aschan, 1913).

SOLUBILITY OF STRONTIUM SULFATE IN AQUEOUS SODIUM CARBONATE AT 25°.

(Herz, 1910.)

Freshly prepared and dried $SrSO_4$ was shaken 5 days with aqueous sodium carbonate solutions and the supernatant clear solutions analyzed.

Normality of Aqueous Na_2CO_3 $\left(\frac{Na_2CO_3}{2}\right)$.	Gm. Mols. per Liter Sat. Sol. $\frac{Na_2CO_3}{2}$.	$\frac{Na_2SO_4}{2}$.
0.6025	0.0382	0.5643
1.205	0.076	1.129
2.41	0.153	2.257

SOLUBILITY OF STRONTIUM SULFATE IN SULFURIC ACID SOLUTIONS.

t°.	Conc. of H_2SO_4.	Gms. $SrSO_4$ per 100 Gms. Acid.	Authority.
ord.	concentrated	5.68	(Sturve, 1870.)
"	fuming	9.77	"
"	91%	0.08	(Varenne and Paulean, 1881.)
70	Sp. Gr. 1.843=99%	14	(Garside, 1875.)
ord.	Absolute H_2SO_4	21.7*	(Bergius, 1910.)

* per 100 cc. Sat. Sol.

SOLUBILITY OF STRONTIUM SULFATE IN AQUEOUS SALT SOLUTIONS.

(Virck, 1862.)

In Aq. NaCl. (a.)	(b)	In Aq. KCl. (a.)	(b)	In Aq. $MgCl_2$. (a)	(b.)	In Aq. $CaCl_2$. (a.)	(b.)
8.44	0.165	8.22	0.193	1.59	0.199	8.67	0.176
15.54	0.219	12.54	0.193	4.03	0.206	16.51	0.185
22.17	0.181	18.08	0.251	13.63	0.242	33.70	0.171

(a) = Gms. salt per 100 gms. aq. solution. (b) = Gms. $SrSO_4$ per 100 gms. solvent.

STRONTIUM TARTRATE $SrC_4H_4O_6.3H_2O$.

SOLUBILITY IN WATER.

(Cantoni and Zachoder, 1905.)

t°.	Gms. $SrC_4H_4O_6.3H_2O$ per 100 cc. Solution.	t°.	Gms. $SrC_4H_4O_6.3H_2O$ per 100 cc. Solution.	t°.	Gms. $SrC_4H_4O_6.3H_2O$ per 100 cc. Solution.
0	0.112	25	0.224	60	0.486
10	0.149	30	0.252	70	0.580
15	0.174	40	0.328	80	0.688
20	0.200	50	0.407	85	0.755

SOLUBILITY OF STRONTIUM TARTRATE IN AQUEOUS SOLUTIONS OF ACETIC ACID AT 26°–27°.

(Herz and Muhs, 1903.)

Normality of Acetic Acid.	Gms. per 100 cc. Solution. CH_3COOH.	$SrC_4H_4O_6.3H_2O$.	Normality of Acetic Acid.	Gms. per 100 cc. Solution. CH_3COOH.	$SrC_4H_4O_6.3H_2O$.
0	0	0.227	3.77	21.85	1.051
0.565	3.39	0.678	5.65	33.90	0.982
1.425	8.15	0.864	16.89	101.34	0.184
2.85	17.10	0.996			

STRONTIUM (Di) TUNGSTATE $SrW_2O_7.3H_2O$.

100 cc. H_2O dissolve 0.35 gm. at 15°. (Lefort, 1878.)

STRYCHNINE $C_{21}H_{22}N_2O_2$.

Solubility in Several Solvents.

Solvent.	t°.	Gms. $C_{21}H_{22}N_2O_2$ per 100 Gms. Solvent.	Solvent.	t°.	Gms. $C_{21}H_{22}N_2O_2$ per 100 Gms. Solvent.
Water	ord. t.	0.014 (1)	Carbon Tetrachloride	20	0.158 (5)
"	20	0.0125 (2)	" "	20	0.22 (9)
"	20	0.0143 (3)	" "	17	0.645 (10)
"	25	0.016 (4)	Chloroform	25	10.25 (6)
"	20	0.021 (5)	"	25	16.6 (14)
Aq. 10% NH_3	20	0.033 (3)	Diethylamine	20	1.7 (3)
Aq. 3% H_3BO_3 in 50% Glycerol	ord. t.	3.5 (1)	Ethyl Acetate	20	0.197 (5)
C_2H_5OH (d=0.83)	15–20	0.71 (7)	Ether	20	0.043 (5)
" (d=0.83)	20	0.833 (3)	"	25	0.018 (4)
" (d=0.83)	25	0.91 (4)	" sat. with H_2O	20	0.051 (5)
" " +10% NH_3	20	0.256 (3)	Glycerol	15	0.25
" (d=0.785)	25	0.70 (6)	Petroleum Ether	20	0.0093 (5)
CH_3OH (d=0.796)	25	0.49 (6)	Piperidine	20	0.7 (3)
Aniline	20	20 (3)	Pyridine	20	1.5 (3)
Amyl Alcohol	25	0.55 (4)	"	26	1.24 (11)
Benzene	20	0.77 (5)	Aq. 50 % Pyridine	20–25	0.43 (8)
"	25	0.76 (6)	Water sat. with Ether	20	0.017 (5)
			Oil of Sesame	20	0.061 (2)

(1) Baroni and Barlinetto (1911); (2) Zalai (1910); (3) Scholtz (1912); (4) U. S. P. 8th ed; (5) Müller (1903); (6) Schaefer (1913); (7) Squire and Caines (1905); (8) Dehn (1917); (9) Gori (1913); (10) Schindelmeiser (1901); (11) Holty (1905).

Solubility of Strychnine in Aqueous Alcohol at 15°–20°.

(Squire and Caines, 1905)

Per cent Alcohol in Solvent	20	45	60	70	90
Gms. $C_{21}H_{22}N_2O_2$ per 100 cc. solvent	0.024	0.125	0.25	0.40	0.59

Solubility of Strychnine in Mixtures of Ether and Chloroform at 25°.

(Marden and Dover, 1916.)

Per cent $CHCl_3$ in Mixed Solvent.	Gms. $C_{21}H_{22}N_2O_2$ per 100 Gms. Mixed Solvent.	Per cent $CHCl_3$ in Mixed Solvent.	Gms. $C_{21}H_{22}N_2O_2$ per 100 Gms. Mixed Solvent.
100	15.3	50	0.35
90	7.1	30	0.21
80	2.77	20	0.15
70	1.5	10	0.09
60	0.65	0	0.02

Solubility of Strychnine in Mixed Solvents at 25°.

(Schaefer, 1913)

Mixture.	Gm. $C_{21}H_{22}N_2O_2$ per 100 cc. of Mixture.
One volume of C_2H_5OH+4 vols. $CHCl_3$	25
One volume of C_2H_5OH+4 vols. C_6H_6	5
One volume of CH_3OH +4 vols. $CHCl_3$	25
One volume of CH_3OH +4 vols. C_6H_6	6.7

Distribution of Strychnine between Water and Chloroform at 25°.

(Seidell, 1910a.)

Gm. $C_{21}H_{22}N_2O_2$ Added per 15 cc. H_2O+15 cc. $CHCl_3$.	Gms. $C_{21}H_{22}N_2O_2$ Recovered per 15 cc: H_2O Layer (a).	Gms. $C_{21}H_{22}N_2O_2$ Recovered per 15 cc: $CHCl_3$ Layer (b).	$\frac{(b)}{(a)}$.
0.005	0.0006	0.0103(?)	...
0.025	0.0010	0.0253	25.2
0.125	0.0021	0.1299	61
0.625	0.0099	0.6225	64

STRYCHNINE ARSENATE $C_{21}H_{22}N_2O_2.H_3AsO_4.\frac{1}{2}H_2O(.1\frac{1}{2}H_2O)$.

100 gms. sat. solution in water contain 4.53 gms. $C_{21}H_{22}N_2O_2.H_3AsO_4$ at 25°. (Puckner and Warren, 1910.)

100 gms. $CHCl_3$ dissolve 0.085 gm. $C_{21}H_{22}N_2O_2.H_3AsO_4$ at 15°. (Hill, 1910.)

STRYCHNINE FORMATE $C_{21}H_{22}N_2O_2.HCOOH.2H_2O$.

SOLUBILITY IN WATER AND IN ALCOHOL.
(Hampshire and Pratt, 1913.)

Solubility in Water.		Solubility in Abs. Alcohol.	
t°.	Gms. Salt per 100 Gms. H_2O.	t°.	Gms. Salt per 100 Gms. C_2H_5OH.
19.5	30.59	18.5	10
24	39.68	20	10.3
27	44.25	22	10.64

STRYCHNINE HYDROBROMIDE $C_{21}H_{22}N_2O_2.HBr$.

100 cc. H_2O dissolve 1.54 gms. of the salt at 15°–20°. (Squire and Caines, 1905.)
100 cc. 90% alcohol dissolve 1.04 gm. of the salt at 15°–20°. " "

STRYCHNINE HYDROCHLORIDE $C_{21}H_{22}N_2O_2.HCl$.

100 cc. H_2O dissolve 2.86 gms. of the salt at 15°–20°. (Squire and Caines, 1905.)
100 cc. 90% alcohol dissolve 1.37 gms. of the salt at 15°–20°. " "
100 gms. $CHCl_3$ dissolve 0.592 gm. of the salt at 15°. (Hill, 1910.

STRYCHNINE NITRATE $C_{21}H_{22}N_2O_2.HNO_3$.

SOLUBILITY IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. Salt per 100 cc. Solvent.	Solvent.	t°.	Gms. Salt per 100 cc. Solvent.
Water	15	1.4 (1)	CH_3OH	25	0.345 (3)
"	15–20	1.6 (2)	$CHCl_3$	25	1.25 (3)
"	25	2.38 (4)	1 vol. C_2H_5OH+4 vols. $CHCl_3$	25	5 (3)
"	80	12.5 (4)	1 vol. C_2H_5OH+4 vols. C_6H_6	25	0.66 (3)
90% C_2H_5OH	15–20	0.83 (2)	1 vol. CH_3OH+4 vols. $CHCl_3$	25	4 (3)
" "	15	0.77 (1)	1 vol. CH_3OH+4 vols. C_6H_6	25	1 (3)
" "	b. pt.	3.45 (1)	Glycerol	25	1.66 (4)
100% C_2H_5OH	25	0.37 (3)			

(1) Dott (1910); (2) Squire and Caines (1905); (3) Schaefer (1913); (4) U. S. P. VIII ed.

DISTRIBUTION OF STRYCHNINE NITRATE BETWEEN WATER AND CHLOROFORM AT 25°.
(Seidell, 1910a.)

Gms. $C_{21}H_{22}N_2O_2.HNO_3$ Added per 15 cc. H_2O + 15 cc. $CHCl_3$.	Gms. $C_{21}H_{22}N_2O_2.HNO_3$ per 15 cc.: H_2O Layer (a).	$CHCl_3$ Layer (b).	$\frac{a}{b}$.
0.005	0.0051	0.0030 (?)	...
0.025	0.0222	0.0042	5.3
0.125	0.1017	0.0243	4.2
0.625	0.3250	0.1698	2

STRYCHNINE OXALATE

100 gms. H_2O dissolve 1.13 gms. of the anhydrous salt at about 15°. (Dott, 1910.)

***STRYCHNINE PERCHLORATE** $C_{21}H_{22}N_2O_2.HClO_4$.

100 gms. H_2O dissolve 0.022 gm. perchlorate at 15°.
(Hofmann, Roth, Höbold and Metzler, 1910.)

STRYCHNINE SULFATE $(C_{21}H_{22}N_2O_2)_2.H_2SO_4.5H_2O$.

SOLUBILITY IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. Salt per 100 cc. Solvent.	Solvent.	t°.	Gms. Salt per 100 cc. Solvent.
Water	15-20	2.08 (1)	$CHCl_3$	15	0.05 (4)
"	25	3.23 (2)	"	25	0.31 (2)
"	80	16.6 (2)	"	25	0.43 (3)
90% C_2H_5OH	15-20	0.74 (1)	1 vol. C_2H_5OH+4 vols. $CHCl_3$	25	12.8 (3)
94% "	25	1.9 (2)	1 vol. C_2H_5OH+4 vols. C_6H_6	25	0.725 (3)
94% "	60	6.2 (2)	1 vol. CH_3OH+4 vols. $CHCl_3$	25	25 (3)
100% "	25	0.8 (3)	1 vol. CH_3OH+4 vols. C_6H_6	25	12.5 (3)
CH_3OH	25	8.33 (3)	Glycerol	15	18 (2)

(1) Squire and Caines (1905); (2) U. S. P. VIII; (3) Schaefer (1913); (4) Hill (1910).

STRYCHNINE TARTRATE

SOLUBILITY OF *d*, *l* AND OF RACEMIC STRYCHNINE TARTRATE IN WATER.
(Dutilh, 1912)

t°.	Gms of Each Separately per 1000 gms. H_2O		
	d Tartrate.	*l* Tartrate.	Racemic Tartrate
7.35	14.14	9.48	14.02
16	17.72	11.50	19.12
25	22.9	14.52	24.70
27	...	15.60	...
30	...	17.02	...
40	35.18	22.90	38.42

SOLUBILITY OF MIXTURES OF *d* AND *l* TARTRATES AND OF RACEMIC STRYCHNINE TARTRATE IN WATER.
(Ladenburg and Doctor, 1899)

Results for *d* + *l* Tartrate.			Results for Racemic Tartrate.		
t°.	Gms. Anhydrous Salt per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. Anhydrous Salt per 100 Gms. H_2O.	Solid Phase.
7	1.48	50% *d*+5% *l*	7	1.39	Racemic Tartrate
19	1.95	"	19	1.90	"
27	2.38	"	27	2.33	"
35	3.02	"	35	3.17	"
42	3.75	"	42	3.92	"

100 gms. sat. solution in water contain 0.45 gm. anhydrous strychnine acid tartrate at about 15°. (Dott, 1910.)

SUBERIC ACID $C_6H_{12}(COOH)_2$.

SOLUBILITY IN WATER.
(Lamouroux, 1899)

t°.	0°.	15°.	20°.	35°.	50°.	65°.
Gms. $C_6H_{12}(COOH)_2$ per 100 cc. sol.	0.08	0.13	0.16	0.45	0.98	2.22

SOLUBILITY OF SUBERIC ACID IN ALCOHOLS AT 4°.
(Timofeiew, 1894.)

Alcohol.	Gms. $C_6H_{12}(COOH)_2$ per 100 Gms.	
	Sat. Sol.	Alcohol.
Methyl Alcohol	20.32	32.04
Ethyl Alcohol	15.5	18.44
Propyl Alcohol	12.2	13.9

100 gms. 95 per cent formic acid dissolve 2.13 gms. $C_6H_{12}(COOH)_2$ at 19.5°. (Aschan, 1913)

Data for the distribution of suberic acid between water and ether at 25° are given by Chandler, 1908.

SUCCINIC ACID $(CH_2)_2(COOH)_2$.

Solubility in Water.

(Miczynski, 1886; van der Stadt, 1902; Lamouroux, 1899; for other concordant results, see Bourgoin, 1874; Henry, 1884.)

t°.	Gms. $(CH_2)_2(COOH)_2$ per 100 Gms. H_2O.	Gms. $(CH_2)_2(COOH)_2$ per 100 cc. Solution.	Gms. Succinic Anhydride $(CH_2)_2COCOO$ per 100 Gms. H_2O.	Mol. Per cent. H_2O.	Mol. Per cent. $(CH_2)_2COCOO$.
0	2.80	2.78 (L.)	2.34	99.58	0.42
10	4.51	4	3.80	99.32	0.68
20	6.89	5.8	5.77	98.97	1.03
25	8.06	7	6.74	98.80	1.20
30	10 58	8.5	8.70	98.44	1.56
40	16.21	12.5	13.42	97.64	2.36
50	24.42	18	19.95	96.53	3.47
60	35.83	24.5	28.77	95.07	4.93
70	51.07	...	40.11	93.26	6.74
80	70 79	...	54.08	91.12	8.88
89.4	95.45	...	70.62	88.71	11.29
104.8	146.3	...	101.2	84.57	15.43
115.1	188.5	...	126.8	81.4	18.6
134.2	335.4	...	187.8	74.72	25.28
159.5	748.2	...	295.2	65 27	34.73
180.6	1839	...	408.5	57.6	42.4
182.8	∞	...	542.3	50	50
174.4	...	...	808.5	40.7	59.3
153.3	...	...	2239	19.86	80.14
128	...	...	8865.	5.89	94.11
118.8–119	...	...	∞	0	100

The following very careful determinations of the solubility of succinic acid in water are given by Marshall and Bain (1910).

t°.	0°.	12 5°.	25°.	37 5°.	50°.	62 5°.	75°.
Gms. $(CH_2)_2(COOH)_2$ per 100 gms. H_2O	2.75	4.92	8.35	14	23.83	39.35	60.37

Solubility of Succinic Acid in Aqueous Solutions of Salts and of Acids at 25°.

(Herz, 1910b, 1911)

In Aq. HBr.

HBr. (Gms per Liter)	$C_4H_6O_4$. (Gms per Liter)
0	81.21
79.3	57.38
274.4	32.83

In Aq. HCl.

HCl (Gms. per Liter)	$C_4H_6O_4$. (Gms. per Liter)
18.45	66.25
45.6	50.78
87.9	35.42
166.6	27.75

In Aq. KBr.

KBr. (Gms. per Liter)	$C_4H_6O_4$. (Gms. per Liter)
0	81.21
65.45	75.58
260.5	69.68
502.1	62.59

In Aq. KCl.

KCl (Gms. per Liter)	$C_4H_6O_4$. (Gms. per Liter)
28.34	75.58
77.56	74.39
150.7	69.68
267	61.41

In Aq. KI.

KI. (Gms. per Liter)	$C_4H_6O_4$. (Gms. per Liter)
0	81.21
46.48	79.12
102.9	77.93

In Aq. LiCl.

LiCl. (Gms. per Liter)	$C_4H_6O_4$. (Gms. per Liter)
0	81.21
7.63	70.86
23.32	62.59
57.66	47.24
117	29.51
176.4	20.07
231.5	14.17

In Aq. NaCl.

NaCl. (Gms. per Liter)	$C_4H_6O_4$. (Gms. per Liter)	Solid Phase.
18.7	74.39	$C_4H_6O_4$
32.73	69.68	"
64.3	61.41	"
132.1	49.55	"
289.4	27.16	"
315.1	22.44	NaCl
318	4.72	"

Solubility of Succinic Acid in Aqueous Solutions of Potassium Succinate and Vice Versa at Several Temperatures.

(Marshall and Cameron. 1907.)

t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.	t°.	Gms. per 100 Gms. Sat. Sol.		Solid Phase.
	$H_2C_4H_4O_4$.	$K_2C_4H_4O_4$.			$H_2C_4H_4O_4$.	$K_2C_4H_4O_4$.	
0	2.71	0	$H_2C_4H_4O_4$	25	7.88	0	$H_2C_4H_4O_4$
0	7.26	8.09	" $+KH_3(C_4H_4O_4)_2$	25	9.965	3.17	"
0	7.86	7.66	" "	25	12.77	8.4	"
0	8.24	9.95	$KH_3(C_4H_4O_4)_2$	25	17.6	14.15	"
0	8.11	12.77	"	25	18.1	14.3	" $+KH_3(C_4H_4O_4)_2$
0	7.87	15.47	" $+KHC_4H_4O_4.2H_2O$	25	15.36	18.48	$KH_3(C_4H_4O_4)_2$
0	0	40.2	$K_2C_4H_4O_4.3H_2O$	25	13.7	23.6	" $+KHC_4H_4O_4$
14	1.468	41.3	$K_2C_4H_4O_4+KHC_4H_4O_4$	25	13.06	23.81	$KHC_4H_4O_4$
			$+KHC_4H_4O_4.2H_2O$	25	11.98	24.43	"
15.9	1.7	34.36	$KHC_4H_4O_4.2H_2O+KHC_4H_4O_4$	25	9.97	25	"
20	6.39	0	$H_2C_4H_4O_4$	25	6.61	28.6	"
20	7.48	1.85	"	25	2.6	38.2	"
20	14.63	11.64	"	25	2.11	40.6	"
20	15.03	13.32	" $+KH_3(C_4H_4O_4)_2$	25	1.03	48.7	" $+K_2C_4H_4O_4.3H_2O$
20	13.32	18.46	$KH_3(C_4H_4O_4)_2$	25	0.13	56.15	$K_2C_4H_4O_4.3H_2O$
20	12.74	22.45	" $+KHC_4H_4O_4$	25	0	58 05	"
20	11.7	22.91	$KHC_4H_4O_4$	40	12.9	0	$H_2C_4H_4O_4$
20	1.71	42.1	"	40	25.5	16.83	" $+KH_3(C_4H_4O_4)_2$
20	1.05	47.3	" $+K_2C_4H_4O_4.3H_2O$	40	19	25.48	$KH_3(C_4H_4O_4)_2+KHC_4H_4O_4$
20	0.985	48.1	$K_2C_4H_4O_4.3H_2O$	40	15.83	26.56	$KHC_4H_4O_4$
20	0.909	48.75	"	40	0	62.10	$K_2C_4H_4O_4.3H_2O$
20	0.159	54.3	"				
20	0	56.6	"				

Solubility of Succinic Acid in Alcohols and in Ether.

(Timofeiew, 1891, 1894, at 15°, Bourgoin, 1878)

Solvent.	Gms $(CH_2)_2(COOH)_2$ per 100 Gms. Solvent at:			
	−1°.	+15°.	+21.5°.	+39°.
Abs. Methyl Alcohol	10.51	...	19.40	28.7
Abs. Ethyl "	5.06	12.59	9.49	15
90% " "	...	7.51	...	...
Abs. Propyl "	2.11	...	4.79	7.53
Abs. Ether	...	1.265	...	...
Isobutyl Alcohol	...	...	2.73	...

100 gms. 95 per cent formic acid dissolve 2.06 gms. $(CH_2)_2(COOH)_2$ at 18.5°. (Aschan, 1913.)

Distribution of Succinic Acid between Water and Amyl Alcohol at 20°.

(Herz and Fischer, 1904.)

Millimols $\frac{1}{2}C_4H_6O_4$ per 10 cc.		Gms. $C_4H_6O_4$ per 100 cc		Millimols $\frac{1}{2}C_4H_6O_4$ per 10 cc.		Gms. $C_4H_6O_4$ per 100 cc.	
Alcohol Layer.	Aq. Layer.	Alcohol Layer.	Aq. Layer.	Alcohol Layer.	Aq. Layer.	Alcohol Layer.	Aq. Layer.
0.1888	0.2684	0.1114	0.1584	3.899	6.0795	2.302	3.588
0.3643	0.5252	0.215	0.310	5.199	8.099	3.069	4.779
0.7077	1.0373	0.418	0.612	6.334	10.170	3.739	6
1.440	2.1266	0.850	1.255	7.119	11.555	4.202	6.821
2.715	4.0495	1.603	2.391				

SOLUBILITY OF SUCCINIC ACID IN AQUEOUS ACETONE AT 20°.
(Herz and Knoch, 1904.)

cc. Acetone per 100 cc. Solution.	$C_4H_6O_4$ per 100 cc. Solution. Millimols.	Gms.	cc. Acetone per 100 cc. Solution.	$C_4H_6O_4$ per 100 cc. Solution. Millimols.	Gms.
0	107.8	6.363	60	275.7	16.27
10	127.4	7.519	70	278.5	16.44
20	155.8	9.194	80	265.3	15.66
30	186.7	11.02	90	201.9	11.91
40	225.4	13.30	100	51.5	3.04
50	254.3	15.01			

SOLUBILITY OF SUCCINIC ACID IN AQUEOUS GLYCEROL SOLUTIONS AT 25°.
(Herz and Knoch, 1905.)

Wt. % Glycerol in Solvent.	$C_4H_6O_4$ per 100 cc. Solution. Millimols.	Gms.	Sp. Gr. of Solutions.	Wt. % Glycerol in Solvent.	$C_4H_6O_4$ per 100 cc. Solution. Millimols.	Gms.	Sp. Gr. of Solutions.
0	133.4	7.874	1.0213	40.95	105.8	6.244	1.1120
7.15	128.2	7.566	1.0407	48.70	99.9	5.896	1.1298
20.44	118.3	6.982	1.0644	69.20	88.5	5.223	1.1804
31.55	109.7	6.476	1.0897	100*	74.6	4.440	1.2530

* Sp. Gr. of Glycerol = 1.2555. Impurity about 1.5 per cent.

DISTRIBUTION OF SUCCINIC ACID BETWEEN WATER AND ETHER AT 15°, 20° AND 25.5°.
(Pinnow, 1915.)

Results at 15°. Aqueous Layer (c).	Ether Layer (c').	$\frac{c}{c'}$.	Results at 20°. Aqueous Layer (c).	Ether Layer (c').	$\frac{c}{c'}$.	Results at 25.5°. Aqueous Layer (c).	Ether Layer (c').	$\frac{c}{c'}$.
0.474	0.0783	6.05	0.644	0.096	6.71	0.3293	0.0438	7.52
0.2585	0.0415	6.23	0.312	0.046	6.87	0.1768	0.0235	7.52
0.1175	0.0187	6.28	0.151	0.0218	6.93	0.0894	0.0116	7.71
			0.0405	0.006	6.75			

(Concentrations in Gm. Mols. per Liter.)

Very careful determinations of this distribution at 0° and at 25°, in which the ionization of the succinic acid in the two solvents is taken into consideration, are given by Chandler, 1908. Two determinations at 0° and two at 15° are quoted by Kolossovsky, 1911. Earlier data for this system are given by Nernst, "Theoretical Chemistry," 3rd English edition, p. 496.

BromSUCCINIC ACID $CHBr(CH_2)(COOH)_2$ (m. pt. 159°).

SOLUBILITY IN ALCOHOLS AT 22°.
(Timofeiew, 1894.)

Alcohol.	Gms. $CHBr(CH_2)(COOH)_2$ per 100 Gms. Sat Solution.	Alcohol
Methyl Alcohol	56.5	129.7
Ethyl Alcohol	45.5	83.6
Propyl Alcohol	33.1	49.4

Data for the distribution of monobromsuccinic acid between water and ether at 25° and for dibromsuccinic acid between water and ether at 25° are given by Chandler (1908).

Data for the melting-points of mixtures of the following pairs of optical antipodes are given by Centnerszwer (1899).

d + *l* Chlorsuccinic Acid.
d + *i* Chlorsuccinic Acid.
d Chlorsuccinic Acid + *l* Bromsuccinic Acid.
i Chlorsuccinic Acid + *l* Bromsuccinic Acid.
d + *l* Benzylaminosuccinic Acid.
d + *l* Aminosuccinic Acid.

SUCCINIMIDE $C_2H_4<{}^{CO}_{CO}>NH$.

SOLUBILITY IN WATER AND IN ETHYL ALCOHOL.

(Speyers, 1902.)

Interpolated from original results.

t°.	In Water. Wt. of 1 cc. Solution.	Mols. per 100 Mols. H_2O.	Gms. per 100 Gms. H_2O.	In Ethyl Alcohol. Wt. of 1 cc. Solution.	Mols. per 100 Mols. C_2H_5OH.	Gms. per 100 Gms C_2H_5OH
0	1.025	1.58	8.69	0.815	0.88	1.89
10	1.035	2.4	14	0.809	1.35	2.7
20	1.052	4	23	0.806	2	4.1
25	1.067	5.9	33	0.805	2.5	5.3
30	1.086	8	45	0.804	3.1	6.8
40	1.120	12.8	70	0.809	4.9	10.5
50	1.145	17.8	96	0.816	7.8	16
60	1.167	22.6	124	0.835	12.3	26.5
70	1.189	27.5	152	0.873	...	...
80	1.204	32.8	...	0.954	...	...

Freezing-point data (solubilities, see footnote, p. 1), are given for ethylsuccinimide + bromotoluene and for ethylsuccinimide + p xylene by Paterno and Ampola (1897).

SUCCINIC NITRILE (Ethylene Cyanide) $CNCH_2CH_2CN$.

The solubility of succinic nitrile in water and also in aqueous sodium chloride solutions at various temperatures has been determined by Schreinemakers (1897), and the results presented in terms of mols. of nitrile per 100 mols. of nitrile + H_2O. The following calculations of these results to gram quantities was made by Rothmund. (Landolt and Bornstein's, "Tabellen" 1906.)

t°.	Gms. $CNCH_2CH_2CN$ per 100 Gms. Aq. Layer.	Nitrile Layer.	t°.	Gms. $CNCH_2CH_2CN$ per 100 Gms. Aq. Layer.	Nitrile Layer.
18.5	10.2	92	53.5	33.2	66.4
20	11	91.5	55	40.3	62.8
39	...	85.2	55.4 crit. temp.	51	
45	22	...			

Very complete data for the system succinic acid nitrile, ethyl alcohol and water, determined by the synthetic sealed-tube method, are given by Schreinemakers (1898c). Results for the system succinic acid nitrile, cane sugar and water are given by Timmermans (1907).

SUGAR $C_{12}H_{22}O_{11}$ (Cane Sugar.)

SOLUBILITY IN WATER.

(Herzfeld, 1892; see also Courtonne, 1877.)

t°.	Gms. $C_{12}H_{22}O_{11}$ per 100 Gms. Solution.	Water.	t°.	Gms. $C_{12}H_{22}O_{11}$ per 100 Gms. Solution.	Water.
0	64.18	179.2	40	70.42	238.1
5	64.87	184.7	45	71.32	248.7
10	65.58	190.5	50	72.25	260.4
15	66.33	197	60	74.18	287.3
20	67.09	203.9	70	76.22	320.4
25	67.89	211.4	80	78.36	362.1
30	68.70	219.5	90	80.61	415.7
35	69.55	228.4	100	82.97	487.2

Sp. Gr. of sat. solution at 15° = 1.329; at 25° = 1.340.

100 gms. H_2O dissolve 212 gms. cane sugar at 25°, determined by means of Pulfrich's refractometer. (Osaka, 1903–08.)

SOLUBILITY OF SUGAR IN AQUEOUS SALT SOLUTIONS AT 30°, 50°, AND 70°.

Interpolated from original results. (Schukow, 1900.)

t°.	Gms. Salt per 100 Gms. H_2O.	Gms. $C_{12}H_{22}O_{11}$ per 100 grams H_2O in Aq. Solution of: KCl.	KBr.	KNO_3.	NaCl.	$CaCl_2$.
30	0	219.5	219.5	219.5	219.5	219.5
"	10	216	218	217	210	197
"	20	221	220	216	211	189
"	30	228	224	216	219	192
"	40	237	228	217	233	200
"	50	...	...	218	250	218
"	60	...	...	...	269	243
50	0	260.4	260.4	260.4	260.4	260.4
"	10	261	262	260	255	239
"	20	266	266	261	260	228
"	30	274	272	262	269	228
"	40	284	276	262	284	236
"	50	296	280	263	302	253
"	60	...	...	...	...	276
70	0	320.5	320.5	320.5	320.5	320.5
"	10	326	324	321	323	295
"	20	334	328	324	330	286
"	30	345	334	327	344	286
"	40	357	341	331	361	295
"	50	370	349	334	384	308
"	60	384	357	337	406	327

SOLUBILITY OF CANE SUGAR IN SATURATED AQUEOUS SALT SOLUTIONS AT 31.25°. (Kohler, 1897.)

Salt.	Gms. Sugar per 100 Gms. Solution.	Water.	Salt.	Gms. Sugar per 100 Gms. Solution.	Water.
CH_3COOK	...	324.8	Na_2CO_3	64.73	229.2
C_3H_7COOK	49.19	306.1	KNO_3	61.36	224.7
$C_3H_4.OH.(COOK)_3$	50.30	303.9	K_2SO_4	66.74	219.0
K_2CO_3	56.0	265.4	CH_3COOCa	60.12	190.0
KCl	62.28	246.5	Na_2SO_4	52.20	183.7
CH_3COONa	59.93	237.6	$CaCl_2$	42.84	135.1
NaCl	62.17	236.3	$MgSO_4$	46.52	119.6

SOLUBILITY OF CANE SUGAR IN AQUEOUS ALCOHOL SOLUTIONS AT 14°. (Schrefeld, 1894.)

Wt. per cent Alcohol.	Wt. per cent Sugar.	Gms. Sugar per 100 cc. Alcohol-H_2O Mixture.	Wt. per cent Alcohol.	Wt. per cent Sugar.	Gms. Sugar per 100 cc. Alcohol-H_2O Mixture.
0	66.2	195.8	50	38.55	62.7
5	64.25	179.7	60	26.70	36.4
10	62.20	164.5	70	12.25	13.9
20	58.55	141.2	80	4.05	4.2
30	54.05	117.8	90	0.95	0.9
40	47.75	91.	100	0.00	0.0

Solubility of Cane Sugar in Aqueous Alcohol Solutions.

(Scheibler, 1872; correction, 1891.)

	Results at 0°.		Results at 14°.				Results at 40°.
Per cent Alcohol by Vol.	Sp. Gr. of Solution at 17.5°.	Gms. Sugar per 100 cc. Solution.	Sp. Gr. of Solution at 17.5°.	Gms per 100 cc. Solution. Sugar.	C_2H_5OH.	H_2O.	Gms. Sugar per 100 cc. Solution.
0	1.325	85.8	1.326	87.5	0	45.10	...
10	1.299	80.7	1.300	81.5	3.91	44.82	95.4
20	1.236	74.2	1.266	74.5	8.52	43 83	90
30	1.229	65.5	1.233	67.9	13.74	41.87	82.2
40	1.182	56.7	1.185	58	20.24	40.38	74.9
50	1 129	45.9	1.131	47.1	28.13	38 02	63.4
60	1.050	32.9	1.058	33.9	37.64	34.47	49.9
70	0.972	18.2	0.975	18.8	46.28	29 57	31.4
80	0.893	6.4	0 895	6.6	61.15	21.95	13.3
90	0.837	0 7	0 838	0.9	71.18	12.83	2.3
97.4	0.806	0.08	0.808	0.36	77.39	3.28	0.5

100 gms. absolute methyl alcohol dissolve 1.18 gms. cane sugar at 19°. (de Bruyn, 1892.)

Solubility of Cane Sugar in Aqueous Acetone at 25°.

(Herz and Knoch, 1904)

Sp. Gr. of Solutions.	cc Acetone per 100 cc Solvent.	Gms Sugar per 100 cc Solution.	Gms per 100 cc Solution. H_2O.	$(CH_3)_2CO$.	$C_{12}H_{22}O_{11}$.
1.3306	0	89.8	43.3	0	89.8
1.2796	20	76 7	42.9	8 4	76.7
1.2491	30	72.1	39.5	13.4	72.1
1.2002	40	59.3	39.8	20 9	59.3
1.1613	45	52.5	39	24 6	52.5

Above 45 cc. acetone per 100 cc. solvent the solution begins to separate into two layers. The lower of these contains 51 gms. sugar per 100 cc. and has Sp. Gr. 1.1522. The upper layer contains so little sugar that the amount could not be determined by the method employed. 100 cc. evaporated in a vacuum desiccator left a residue of 3.68 gms. Above the concentration of 80 cc. acetone per 100 cc. solvent the two layers unite. In pure acetone 100 cc. solution gave a residue of 0.18 gm. sugar.

Solubility of Several Sugars in Pyridine at 26°.

(Holty, 1905)

Sugar.	Formula.	d_{26} of Sat. Sol.	Gms. Sugar per 100 Gms. Sat Sol.	
Cane Sugar (Sucrose)	$C_{12}H_{22}O_{11}$	...	6.45	
Milk Sugar (Lactose)	$C_{12}H_{22}O_{11}.H_2O$	0.981	2 18	
Grape Sugar (Glucose)	$d\ C_6H_{12}O_6\ H_2O$	1.005	7.62	
Fruit Sugar (Fructose)	$l\ C_6H_{12}O_6$	1.052	18.49+	
Galactose	$C_6H_{12}O_6$	1.0065	5 45(?)	
Maltose	$C_{12}H_{22}O_{11}$	...	98.10*	(Dehn, 1917.)
Mannose	$C_6H_{12}O_6$	...	29.9*	"
Raffinose	$C_{18}H_{32}O_{16}.5H_2O$	...	75*	"

* It is uncertain whether these figures refer to gms. per 100 gms. sat. solution or gms. per 100 gms. pyridine at 20°–25°.

100 gms. aq. 50 per cent pyridine dissolve the following gms. of sugars at 20°–25°; sucrose, 38.5; maltose, 43.07; mannose, 78.70; lactose, 1.98; fructose, 85.42; galactose, 68.3; glucose, 49.17; raffinose, 8.76. (Dehn, 1917.)

100 gms. trichlorethylene dissolve 0.004 gm. cane sugar at 15°. (Wester & Bruins, 1914.)

For additional data on **Galactose**, see p. 305 and on **Glucose**, see p. 306.

Solubility of Milk Sugar (Lactose) Hydrate and β Anhydride in Water.

(Hudson, 1904, 1908.)

It was found that the saturation point was reached very slowly with this compound. From the results, it was concluded that "aqueous solutions of milk-sugar contain two substances in equilibrium and that the mutarotation of milk-sugar results from the slow establishment, in cold solutions, of the equilibrium of the balanced reaction, $C_{12}H_{24}O_{12}$ (Hydrate) $\rightleftarrows$ H_2O + $C_{12}H_{22}O_{11}$ (β-anhydride).

The final solubility of hydrated milk sugar was determined by approaching saturation from below and from above with mixtures of water and excess of once recrystallized hydrated milk sugar. These were constantly rotated until equilibrium was reached (one week was allowed in all cases). The filtered saturated solutions were evaporated to dryness and the crystalline residues, consisting of the α and β anhydrides, weighed.

t°.	Gms. $C_{12}H_{22}O_{11}$ per 100 Gms. Sat. Sol.	t°.	Gms. $C_{12}H_{22}O_{11}$ per 100 Gms. Sat. Sol.
0	10.6	49	29.8
15	14.5	64	39.7
25	17.8	74	46.3
39	24	89	58.2

The initial solubility, obtained by agitating an excess of milk sugar hydrate with water for a few minutes, was somewhat less than one-half the above figures, at temperatures up to 25°.

The final solubility of β anhydrous milk sugar was difficult of determination on account of the high concentration and instability of the saturated solution below 92°. At 0° the final saturation was hastened by addition of 0.1 *n* NH_4OH solution. At 0°, 42.9 gms. $C_{12}H_{22}O_{11}$ per 100 gms. sat. solution were found and at 100°, 61.2 gms.

Solubility of Several Sugars in Aqueous Alcohol at 20°.

(Hudson and Yanovsky, 1917.)

Sugar.	Formula.	Solvent.	Gms Anhydrous Sugar per 100 cc. Solution: Initial Solubility.	Final Solubility.
α Arabinose	$C_5H_{10}O_5$	80% C_2H_5OH	0.74	1.94
β Cellose	$C_{12}H_{22}O_{11}$	20% "	3 2	4.7
β Fructose	$C_6H_{12}O_6$	80% "	13.4	27.4
β "	"	95% "	1.8	4.2
β "	"	Methyl Alcohol	5.2	11.1
α Galactose	$C_6H_{12}O_6$	60% C_2H_5OH	1 1	3.1
α "	"	80% "	0.27	0.65
β, α Glucoheptose	$C_7H_{14}O_7$	20% "	4	4.5
α Glucose	$C_6H_{12}O_6$	80% "	2	4.5
α "	"	Methyl Alcohol	0.85	1.6
α " hydrate	$C_6H_{12}O_6.H_2O$	80% C_2H_5OH	1.3	3
β Glucose	$C_6H_{12}O_6$.	80% "	4 9	9.1
α Lactose hydrate	$C_{12}H_{22}O_{11}.H_2O$	40% "	1.1	2.4
α Lyxose	$C_5H_{11}O_5$	90% "	5.4	7.9
β Maltose hydrate	$C_{12}H_{22}O_{11}$ H_2O	60% "	3	4.75
β Mannose	$C_6H_{12}O_6$	80% "	2.4	13
β "	"	Methyl Alcohol	0.78	4.4
β Mellibose Dihydrate	$C_{12}H_{22}O_{11}$ $2H_2O$	80% C_2H_5OH	0.76	1.3
α Rhamnose Hydrate	$C_6H_{12}O_5$ H_2O	100% "	8.6	9.5
α " "	"	70% "	8.2	9.6
α Xylose	$C_5H_{10}O_5$	80% "	2.7	6.2
Sucrose	$C_{12}H_{22}O_{11}$	80% "	3.7	3.7
Trehalose Dihydrate	$C_{12}H_{22}O_{11}.2H_2O$	70% "	1.8	1.8
Raffinose Pentahydrate	$C_{18}H_{32}O_{16}.5H_2O$	50% "	1.4	1.4

Solubility of Sorbose and Gulose in Water and Alcohols.

(de Bruyn and van Ekenstein, 1900.)

Sugar.	M.-pt.	Gms. Sugar per 100 cc. Sat. Sol in:		
		H_2O at 100°.	CH_3OH at 17°.	C_2H_5OH at 17°.
d Sorbose	151	0.22	1.70	1.02
l Sorbose	150	0.23	1.68	1
l Gulose	150	0.24	1.72	1.04

100 gms. H_2O dissolve 108 gms. maltose at 20°–25°. (Dehn, 1917.)
100 gms. H_2O dissolve 14.3 gms. raffinose at 20°–25°. "

Solubility of Phenylhydrazones and β Naphthylhydrazones of the Sugars in Water and in Alcohols at 16°–18°.

(van Ekenstein and de Bruyn, 1896.)

The hydrazones were prepared by adding to a concentrated and warm solution of the sugar the equivalent quantity of the hydrazine dissolved in the molecular quantity of glacial acetic acid. The precipitated hydrazones were recrystallized from 30 to 50 per cent alcohol. No details in regard to the method of obtaining saturation or of analysis of the solutions are given.

Phenylhydrazone of:	M.-pt.	Gms. Compound per 100 cc. Sat. Sol. in:		
		Water.	CH_3OH.	C_2H_5OH.
Methyl Mannose	178	0.2–0.06	0.59	0.05–0.02
" Arabinose	161	"	...	"
" Rhamnose	124	"	very sl. sol.	"
" Galactose	180	"	"	"
Ethyl Galactose	169	...	...	0.1
" Mannose	159	...	...	0.2
" Arabinose	153	...	...	0.4
" Rhamnose	123	...	very sl. sol.	...
Amyl Galactose	116	...	...	0.6
" Mannose	134	...	...	3.5
" Arabinose	120	...	...	3.6
" Rhamnose	99	...	very sl. sol.	6 5
" Glucose	128	...	...	1.2
" Lactose	123	...	...	0.4
Allyl Galactose	157	...	...	0.3
" Mannose	142	...	...	0.7
" Arabinose	145	...	...	0.5
" Rhamnose	135	...	...	...
" Glucose	155	...	...	...
" Lactose	132	...	...	0.2
" Melibose	192	...	...	0.3
Benzyl Galactose	154	...	0.9	0.08
" Mannose	165	...	0.55	0.2
" Arabinose	170	...	0.4	0.06
" Rhamnose	121	...	15.4	6.7
" Glucose	150	...	0.5	0.10
" Lactose	128	...	0.9	0.06
β Naphthyl Galactose	167	0.14	...	0.24*
" Mannose	157	0.18	...	0.25*
" Arabinose	141	0.22	...	0.62*
" Rhamnose	170	0.20	...	0.44*
" Glucose	95	0.25	...	5*
" Xylose	70	0.32	...	6.62*
" Lactose	203	0.07	...	0.2*
" Maltose	176	...	...	0.4*
" Melibose	135	...	...	1.3*

* Solvent 96 per cent C_2H_5OH.

SOLUBILITY OF THE BENZALIC COMPOUNDS OF SOME POLYATOMIC ALCOHOLS AT 16°–18°.

(de Bruyn and van Ekenstein, 1899.)

No details of the determinations are given. It is stated that the results are sufficiently exact for use in identifying hexites.

Name of Compound.	M.-pt.		Gms. Compd. Dissolved per 100 cc. Sat. Sol. in: Acetone.	Chloroform.	Alcohol.
Dibenzalerythritol	201	(Fischer)	0.34	3.64	0.02
Monobenzalarabitol	152	"	...	...	...
Dibenzaladonitol	165	"	0.64	1.36	0.14
Dibenzalxylitol	175	"	1.10	0.85	...
Dibenzalrhamnitol	203	"	0.70	2.55	1.10
Monobenzal-*d*-Sorbitol	175	(Meunier)	very easily soluble		
Dibenzal-*d*-Sorbitol	163	"	5.44	0.16	0.10
Tribenzalmannitol	213–8	(Fischer)	0.42	8.75	0.10
Tribenzal-*l*-iditol*	215–8	"	0.47	0.17	0.05
Tribenzal-*d*-talitol†	210	"	0.30	4.42	trace
Dibenzaldulcitol	215–20	"	0.42	0.83	trace
Dibenzalperseitol	230–5	"	0.04	trace	0.02

* Prepared from *l* idonic acid. † Prepared from *d* talonic acid.

100 gms. sat. solution in pyridine contain 0.47 gm. mannitol at 26°. (Holty, 1905.)
100 gms. sat. solution in pyridine contain 2.5(?) gms. erythritol at 26°. "

SULFANILIC ACID $NH_2.C_6H_4.SO_3H.H_2O$.

SOLUBILITY IN WATER.

(Philip, 1913; results for 60° and over by Dolinski, 1905)

t°.	Gms NH_2-$C_6H_4SO_3H$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. NH_2-$C_6H_4SO_3H$ per 100 Gms. Sat. Sol.	Solid Phase.
0	0.444	$NH_2.C_6H_4.SO_3H.2H_2O$	44	2.44	$NH_2.C_6H_4.SO_3H.H_2O$
7.2	0.622	"	44	2.36	$NH_2.C_6H_4.SO_3H$
13.3	0.841	"	47.5	2.52	"
18.9	1.093	"	54.5	2.85	"
18.9	1.137	$NH_2.C_6H_4.SO_3H.H_2O$	60	3.01	"
25.1	1.384	"	70	3.65	"
31.1	1.662	"	80	4.32	"
37.2	2.004	"	100	6.26	"

SULFONIUM PERCHLORATES

SOLUBILITY IN WATER.

(Hofmann, Höbold and Quoos, 1911–12.)

Name.		Formula.	t°.	Per 100 Gms. H_2O. Gm. Mols.	= Gms.
Trimethyl	Sulfine Perchlorate	$(CH_3)_3SClO_4$	16.5	0.0784	13.84
Ethyl dimethyl	" "	$C_2H_5(CH_3)_2SClO_4$	15.9	0.1191	22.31
Propyl "	" "	$C_3H_7(CH_3)_2SClO_4$	15	0.0590	12.04
n Butyl "	" "	$C_4H_9(CH_3)_2SClO_4$	15	0.0607	13.24
Ethylene *dis*methyl	" "	$C_2H_4(C_2H_6SClO_4)_2$	18	0.0423	14.86
Vinyl dimethyl	" "	$C_2H_3.S(CH_3)_2.ClO_4$	18	0.0731	13.75
Trimethylene *dis*methyl "	"	$C_3H_6:(C_2H_6SClO_4)_2$	18	0.0402	14.68

Triethyl**SULFONIUM IODIDE** $S(C_2H_5)_3I$.

100 gms. H_2O dissolve 431 gms. $S(C_2H_5)_3I$ at 25°. (Peddle and Turner, 1913.)
100 gms. $CHCl_3$ dissolve 47.7 gms. $S(C_2H_5)_3I$ at 25°. (Peddle and Turner, 1913.)

SULFUR S.

In a series of papers by Aten (1905–06, 1912, 1912–13, 1913, 1914 and 1914a), the preparation and properties of the four known modifications of sulfur are described. These are designated by the symbols, S_λ, S_μ, S_π and S_ρ.

S_λ is ordinary rhombic sulfur and its molecule is considered to be composed of eight atoms of sulfur, S_8.

S_μ is the insoluble, so-called amorphous sulfur.

S_π is obtained when ordinary sulfur is heated above its melting-point and quickly cooled; it is especially easily prepared by warming S_λ in sulfur chloride. Its molecule is probably represented by S_4.

S_ρ was discovered by Engel and is prepared by mixing concentrated HCl, cooled to 0°, with saturated sodium thiosulfate solution. The precipitated NaCl is removed by filtration and the solution extracted with toluene. The aqueous layer soon yields a cloudy precipitate of S_ρ. The molecule of this sulfur is considered to have the composition S_6.

Solubility of Sulfur (S_λ) in Sulfur Monochloride (S_2Cl_2) Determined by the Melting-point Method.

(Aten, 1905–06.)

t° of Melting.	Mol % S_8 in Mixture.	Solid Phase.	t° of Melting.	Mol % S_8 in Mixture.	Solid Phase.
−16	4.3	Rhombic S	83.5	67	Rhombic S
0	6	"	95.6	81.8	"
+17.9	9.9	"	86	81.8	Monoclinic S
36.8	17.1	"	103.2	88.4	"
55.2	28.5	"	110.4	95	"
65.6	40.3	"	118.8	100	"
77.7	55.4	"			

Solubility of Sulfur (S_π) in Sulfur Monochloride (S_2Cl_2)

(Aten, 1912–13)

A preliminary experiment showed that if a solution of S_λ in sulfur monochloride, saturated at 20°, is heated to 170° and cooled, it will then dissolve as much S_λ as already required to saturate it. The following determinations were made by sealing known amounts of S_λ and S_2Cl_2 in tubes, heating them to 100° for several hours and then cooling quickly to the indicated temperatures and shaking for ½ hour in the case of the 0° and 25° results and 2 hours in the case of the −60° results. The saturated solutions were analyzed by oxidizing with HCl + HNO_3 + Br and titrating the H_2SO_4, after removing the volatile acids.

Atoms S per 100 Atoms S+S_2Cl_2 in:				Atoms S per 100 Atoms S+S_2Cl_2 in:			
Original Mixture.	Saturated Solution at:			Original Mixture.	Saturated Solution at:		
	−60°.	0°.	+25°.		−60°.	0°.	+25°.
0	11.6	36.1	53.5	79.4	65.2	72	...
10	18.1	40.1	57.6	80.1	66.1	71.6	...
28.7	31.9	47.4	62	89.9	...	...	82.1
49.9	42.9	56	66.4	90.1	...	80.5	...
60.1	47.7	59.9	69.4	94.6	...	...	87.7
69.1	...	...	72.8	98	...	...	93.4

Results similar to the above are also given (Aten, 1912), for mixtures previously heated to 50°, 75° and 125°. All the data confirm the formation of the the new modification S_π.

SOLUBILITY OF SULFUR (S_π) IN SULFUR MONOCHLORIDE (S_2Cl_2) AT 25°.

(Aten, 1912, 1913.)

The samples were heated to the temperatures indicated and rapidly cooled and powdered. The method of determining the solubilities is not described.

Previous Treatment of Sample.	Atoms S Dissolved per 100 Atoms $S+S_2Cl_2$.	
Unheated Sulfur	53.5	
Mixture of Rhombic and Amorphous Sulfur	54.5	
Rhombic Sulfur heated to 125°	56–58.5	(depending on excess of S present.)
" " " " 165°	60	(determined immediately.)
" " " " 165°	59.5	" after 1 hr.)
" " " " 165°	57.5	" " 24 hrs.)
" " " " 165°	53.2	" " 8 days.)

SOLUBILITY OF SULFUR (S_π) IN TOLUENE AT 0° AND AT 25°.

(Aten, 1913)

Comp. of Mixture in Atom Per cent S.	Solubility in Atom % S. At 0°.	At 25°.	Comp. of Mixture in Atom Per cent S.	Solubility in Atom % S. At 0°.	At 25°.
35	2.88	5.94	74	4.05	7.52
47	...	6.65	77	3.90	...
54	3.26	6.76	80	4.22	...
57	3.30	6.88	83	...	7.93
73	...	7.45	85	...	8.08

These results show that the greater the excess of S_π, the greater the solubility. It was found that under the same conditions, unchanged rhombic sulfur gives constant figures irrespective of the excess of S present. At 0°, 2.59 atom per cent S_λ was found and at 25°, 5.65 atom per cent.

SOLUBILITY OF SULFUR (S_μ) IN CARBON DISULFIDE AND CARBON TETRACHLORIDE.

(Wigand, 1910)

When "insoluble" sulfur (S_μ) is treated with CS_2 or CCl_4, a small amount dissolves, depending upon the length of time of contact, temperature and nature of the solvent but not on the relative amount of solvent. This action is explained on the assumption that a partial transformation of S_μ to soluble sulfur S_λ, takes place.

Data for the fusion points of mixtures of rhombic sulfur and "insoluble" sulfur (S_μ) and for monoclinic sulfur and "insoluble" sulfur (S_μ) are given by Kruyt (1908).

SOLUBILITY OF SULFUR IN LIQUID AMMONIA.

(Ruff and Hecht, 1911)

At the temperatures 0° to 40°, the solutions were constantly shaken for 3 to 4 days. For the results at the lower temperatures the solutions were saturated at room temperature then cooled, partially evaporated and shaken 4 to 6 hours. The saturated solutions were analyzed by evaporation of the ammonia by means of a current of hydrogen, absorbing in HCl and converting to the platinic chloride for weighing. The S residues were dried at 100°, with proper precautions, and weighed.

t°.	Gms. S per 100 Gms. Sat. Solution.	t°.	Gms. S per 100 Gms. Sat. Solution.
−78	38.6*	+16.4	25.65
−20.5	38.1*	30	21
0	32.34	40	18.5

* This figure corresponds to the compound $S(NH_3)_2$ = 38.5% S.

SOLUBILITY OF SULFUR IN AQUEOUS SODIUM SULFIDE SOLUTIONS.

(Küster and Heberlein, 1905.)

The results are expressed in terms of x which represents the number of S atoms dissolved for each Na_2 in the solution. The figures, therefore, show the atomic ratio of S to Na_2 in the saturated solution and at the same time, the sulfur content of the compound Na_2S_x which is formed. In order to find the actual amount of sulfur dissolved per liter, it is only necessary to multiply the x value by the normality of the aqueous sodium sulfide solution used as solvent in the particular case.

A series of determinations made at 25°, by agitating aqueous sodium sulfide solutions with crystalline sulfur until equilibrium was reached, and then diluting each solution with an equal volume of water and shaking with excess of sulfur until equilibrium was again reached, gave the following results:

Normality of the Aq. Na_2S Solution.	x in the Resulting Na_2S_x.	Normality of the Aq. Na_2S Solution.	x in the Resulting Na_2S_x.
4	4.475	0.125 (32 hrs.)	5.225
2 (2 hrs.)	4.666	0.0625	5.239
1	4.845	0.03125	5.198
0.5	4.984	0.015625	5.034
0.25	5.115	0.007812 (128 hrs.)	4.456

The figures in parentheses in the above table show the number of hours required for attainment of equilibrium in these three cases. The authors also made determinations of the influence of temperature on the amount of sulfur dissolved, and found that for a normal Na_2S solution, the x value did not vary appreciably from the figure given above, over the range 0° to 50°.

Results are also given showing the influence of the presence of NaCl and of KOH on the amount of sulfur dissolved by aqueous Na_2S solutions. In the former case the solubility was distinctly lowered, while in the latter it was notably increased.

SOLUBILITY OF SULFUR IN:

Tin Tetrachloride.

(Gerardin, 1865.)

t°.	Gms. S per 100 Gms. $SnCl_4$.	Solid Phase.
99	5.8	Solid S
101	6.2	"
110	8.7–9.1	"
112	9.4–9.9	Liquid S
121	17.0	"

Amyl Alcohol.

(Gerardin.)

t°.	Gms. S per 100 Gms. $C_5H_{11}OH$.	Solid Phase.
95	1.5	Solid S
110	2.1–2.2	"
112	2.6–2.7	Liquid S
120	3.0	"
131	5.3	"

SOLUBILITY OF SULFUR IN AQUEOUS ACETONE AT 25°.

(Herz and Knoch, 1905.)

Wt. Per cent Acetone in Solvent.	Sulfur per 100 cc. Solution.		Sp. Gr. of Solution.
	Millimols.	Gms.	
100	65	2.084	0.7854
95.36	45	1.442	0.7911
90.62	33	1.058	0.8165
85.38	25.3	0.811	0.8295

Solubility of Sulfur in Ethyl and Methyl Alcohols.

t°.	Alcohol.	Gms. per 100 Gms. Alcohol.	Authority.
15	Abs. Ethyl	0.051	(Pohl.)
18.5	"	0.053	(de Bruyn — Z. physik. Chem. 10, 781, '92.)
b. pt.	"	0.42	(Payen — Compt. rend. 34, 356, '52.)
18.5	Abs. Methyl	0.028	(de Bruyn.)

Solubility of Sulfur in Benzene and in Ethylene Dibromide.

(Etard, 1894; see also Cossa, 1868.)

In C_6H_6.				In $C_2H_4Br_2$.			
t°.	Gms. S per 100 Gms. Solution.	t°.	Gms. S per 100 Gms. Solution.	t°.	Gms. S per 100 Gms. Solution.	t°.	Gms. S per 100 Gms. Solution.
0	1.0	70	8.0	0	1.2	50	6.4
10	1.3	80	10.5	10	1.7	60	8.4
20	1.7	90	13.8	20	2.3	70	11.4
25	2.1	100	17.5	25	2.8	80	16.5
30	2.4	110	23.0	30	3.3	90	24.0
40	3.2	120	29.0	40	4.4	100	36.5
50	4.3	130	36.0				
60	6.0						

Reciprocal Solubility of Sulfur and Benzene, Determined by the Synthetic Method.

(Kruyt, 1908–09.)

Wt. % S in Mixture.	Limiting t° of Homogeneity.		Wt. % S in Mixture.	Limiting t° of Homogeneity.	
	Lower.	Upper.		Lower.	Upper.
41.5	146	247	79.8	141	230
55.2	158	230	81.4	138	above 246
74.5	157	226	83.4	131	" 272

100 gms. sat. solution of S in benzoyl chloride, $C_6H_5.COCl$, contain 1 gm. S at 0° and 55.8 gms. at 134°. (Bogousky, 1905.)

Solubility of Octohedral and of Prismatic Sulfur in Several Solvents.

(Brönsted, 1906.)

The solubility of prismatic sulfur could not be determined in the ordinary way on account of its rapid transition to octohedral sulfur. A special apparatus was used which permitted the solvent to remain in contact with the solid for only a short time. Since sulfur dissolves very rapidly, this procedure was found to give satisfactory results.

Solvent.	t°.	Gms. each Variety Separately per 100 cc Saturated Solution.	
		Prismatic Sulfur.	Octohedral Sulfur.
Benzene	18.6	2.004	1.512
"	25.3	2.335	1.835
Chloroform	0	1.101	0.788
"	15.5	1.658	1.253
"	40	2.9	2.4
Ethyl Ether	0	0.113	0.080
"	25.3	0.253	0.200
Ethyl Bromide	0	0.852	0.611
"	25.3	1.676	1.307
Ethyl Formate	0	0.028	0.019
Ethyl Alcohol	25.3	0.066	0.052

SOLUBILITY OF SULFUR IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. S per 100 Gms. Solvent.	Solvent.	t°.	Gms. S per 100 Gms. Solvent.
Aniline	130	85.3 (1)	Glycerol	15.5	0.14 (4)
Benzene	15.2	1.5 (2)	Hydrazine (anhy.)	room temp.	54 (decomp.) (5)
"	19.3	1.7 (2)	Lanoline (anhy.)	45	0.38 (6)
"	26	0.97 (1)	Methylene Iodide	10	10 (7)
"	71	4.38 (1)	Nicotine	100	10.6 (8)
Carbon Tetrachloride	25	0.86 (3)	Phenol	174	16.4 (1)
Chloroform	12.2	0.75 (2)	Pentachlor Ethane	25	1.2 (3)
"	19.3	0.92 (2)	Toluene	23	1.48 (1)
"	22	1.21 (1)	Tetrachlor Ethane	25	1.23 (3)
Dichlor Ethylene	25	1.28 (3)	Tetrachlor Ethylene	25	1.53 (3)
Ethylene Chloride	25	0.84 (3)	Trichlor Ethylene	25	1.63 (3)
Ethyl Ether	23.5	0.97 (1)	"	15	1.16 (9)

(1) Cossa, 1868; (2) Brönsted, 1906; (3) Hoffman, Kirmreuther and Thal, 1910; (4) Ossendowski, 1907; (5) Welsh and Broderson, 1915; (6) Klose, 1907; (7) Retgers, 1893; (8) Kleven, 1872, (9) Wester and Bruins, 1914.

SOLUBILITY OF SULFUR IN CARBON DISULFIDE.

(Etard, 1894; Cossa, 1865; at 10°, Retgers, 1893; below 77°, Arctowski, 1895–96.)

t°.	Gms. S per 100 Gms. Solution.	Gms. S per 100 Gms. CS_2	t°.	Gms. S per 100 Gms. Solution.	Gms. S per 100 Gms. CS_2.	t°.	Gms. S per 100 Gms. Solution.	Gms. S per 100 Gms. CS_2.
−110	3.0	3.1	−10	13.5	15.6	50	59.0	143.9
−100	3.5	3.6	0	18.0	22.0	60	66.0	194.1
−80	4.0	4.2	10	23.0*	29.9	70	72.0	257.1
−60	3.5	3.6	20	29.5	41.8	80	79.0	376.1
−40	6.0	6.4	25	33.5	50.4	90	86.0	614.1
−20	10.5	11.7	30	38.0	61.3	100	92.0	1150.0
			40	50.0	100.0			

* 26.4 R.

Sp. Gr. of solution saturated at 15° containing 26 gms. S per 100 gms. solution = 1.372.

SOLUBILITY OF SULFUR IN HEXANE (C_6H_{14}).

(Etard.)

t°.	Gms. S per 100 Gms. Solution.	t°.	Gms. S per 100 Gms. Solution.	t°.	Gms. S per 100 Gms. Solution.
−20	0.07	60	1.0	130	5.2
0	0.16	80	1.7	140	6.0
20	0.25	100	2.8	160	7.2
40	0.55	120	4.4	180	8.2

SOLUBILITY OF SULFUR (S_λ) IN β NAPHTHOL, DETERMINED BY THE SYNTHETIC METHOD.

(Smith, Holmes and Hall, 1905.)

The mixtures of sulfur and β naphthol were heated until they were homogeneous and then cooled to the temperature at which clouding appeared.

t° of Clouding.	Gms. S per 100 Gms. β Naphthol.	t° of Clouding.	Gms. S per 100 Gms. β Naphthol.	t° of Clouding.	Gms. S per 100 Gms. β Naphthol.
118	34	154	84.1	164	209.7
132.5	46.6	157	97.4	163.8	238.1
134.5	48.8	160.5	119.3	163.8	264.8*
143.5	59.3	162.5	145.1	163	300 *
149.5	70	163.5	177.6		

* Solid phase, β naphthol.

SOLUBILITY OF SULFUR IN COAL TAR OIL, LINSEED OIL AND IN OLIVE OIL.
(Pelouze, 1869; Pohl.)

t°.	Grams S per 100 Grams Coal Tar Oil of: Sp. Gr.: 0.87 b. pt.: 80°-100°.	0.88 85°-120°.	0.882 120°-220°.	0.885 150°-200°.	1.01 210°-300°.	1.02 220°-300°.	G. S per 100 Gms. Linseed Oil.	Olive Oil of 0.885 Sp. Gr
15	2.1	2.3	2.5	2.6	6.0	7.0	0.4	2.3
30	3.0	4.0	5.3	5.8	8.5	8.5	0.6	4.3
50	5.2	6.1	8.3	8.7	10.0	12.0	1.2	9.0
80	11.8	13.7	15.2	21.0	37.0	41.0	2.2	18.0
100	15.2	18.7	23.0	26.4	52.5	54.0	3.0	25.0
110	...	23.0	26.2	31.0	105.0	115.0	3.5	30.0
120	...	27.0	32.0	38.0	∞	∞	4.2	37.0
130	...	...	38.7	43.8	∞	∞	5.0	43.0
						(160°)	10.0	

100 gms. oil of turpentine dissolve 1.35 gms. S at 16°, and 16.2 gms. at b. pt.
(Payen, 1852.)

SOLUBILITY OF SULFUR IN TRIPHENYL METHANE, DETERMINED BY THE SYNTHETIC METHOD.

Results of Smith, Holmes & Hall, 1905. % Triphenyl Methane in Mixture.	t° of First Limit of Mixing.	% Triphenyl Methane in Mixture.	t° of Second Limit of Mixing.	Results of Kruyt, 1908-09. % Triphenyl Methane in Mixture.	t° of First Limit of Mixing.	% Triphenyl Methane in Mixture.	t° of Second Limit of Mixing.
69.1	108.5	35.5	214.5	66.7	113	7	211.5
58.8	127	32.5	211	60.2	125.3	9.3	201.5
50.8	136.5	28.4	206	50.2	136.8	12	198.8
46.6	141	24.5	203	41	144.2	13.7	199.5
42.8	144	21.6	200	30.8	146	16.4	200.4
37.8	146	19.2	199	20	145.2	19.8	202.1
33.7	146.5	15.4	198	13.2	137.6	23.5	203.7
30.3	147			8.1	118.6	28.7	208
25.4	146			7	crystals	34.5	215.2

SOLUBILITY OF SULFUR IN PHENOL, DETERMINED BY THE SYNTHETIC METHOD.
(Smith, Holmes and Hall, 1905)

The mixtures of sulfur and phenol were heated until they were homogeneous and then cooled to the temperature at which clouding appeared.

t° of Clouding.	Gms. S per 100 Gms. Phenol.	t° of Clouding.	Gms. S per 100 Gms. Phenol.	t° of Clouding.	Gms. S per 100 Gms. Phenol.
89.5	9.1	155	26.3	166	31.6
96.5	10.4	157.5	27.1	167.5	32.4
122.5	15.3	160.5	28.6	170	33.5
138	19.9	162	29.6	172	34.9
148.5	23.6	164.5	30.7	175	36.5

RECIPROCAL SOLUBILITY OF SULFUR AND TOLUENE, DETERMINED BY THE SYNTHETIC METHOD.
(Kruyt, 1908-09.)

Wt. % S in Mixture.	Limiting t° of Homogeneity. Lower.	Upper.	Wt. % S in Mixture.	Limiting t° of Homogeneity. Lower.	Upper.
50.5	167	250	75.7	178	221
62	179	223	77.9	174	...
69.6	180	222	83.3	160	223
73	180	222	90.5	124	above 250

RECIPROCAL SOLUBILITY OF SULFUR AND META XYLENE, DETERMINED BY THE SYNTHETIC METHOD.

(Kruyt, 1908–09.)

Wt. % S in Mixture.	Limiting t° of Homogeneity. Lower.	Upper.	Wt. % S in Mixture.	Limiting t° of Homogeneity. Lower.	Upper.
50.9	181	213	39.9	152	none (230)
49.1	177	228	84.2	none	"
47.7	172.5	none (?)	86.1	164.5	199
44.2	161.5	" (255)	87	159	202.5
40.4	153.5	" (215)	90	139	none (220)

Fusion-point data for the system sulfur-tellurium are given by Pelabon (1909); Pellini (1909); Chikashige (1911, 1911–12); Jaeger and Menke (1912).

Data for mixtures of sulfur and each of the following metals are given by Pelabon (1909); antimony, tin, lead, silver, gold and arsenic.

SULFUR DIOXIDE SO_2

SOLUBILITY IN WATER.

(Schönfeld, 1855; Sims, 1861; Roozeboom, 1884.)

t°.	Schönfeld. Vols. SO_2 (at 0° and 760 mm.) per 1 Vol. Sat. SO_2 + Aq.	H₂O.	Gms. SO_2 per 100 Gms. H_2O at total pressure 760 mm.	t°.	Sims. SO_2 per 1 Gm. H_2O. Gms.	Vols.	t°.	Roozeboom. SO_2 Dissolved per 1 pt. H_2O at 760 mm. pressure.
0	68.86	79.79	22.83	8	0.168	58.7	0	0.236
5	59.82	67.48	19.31	10	0.154	53.9	2	0.218
10	51.38	56.65	16 21	14	0.130	45.6	4	0.201
15	43.56	47.28	13.54	20	0.104	36.4	6	0.184
20	36.21	39.37	11.29	26	0.087	30.5	7	0.176
25	30.77	32.79	9.41	30	0.078	27.3	8	0.168
30	25.82	27.16	7.81	36	0.065	22.8	10	0.154
35	21.23	22.49	...	40	0.058	20.4		
40	17.01	18.77	5.41	46	0.050	17.4	12	0.142
				50	0.045	15.6		

Sp. Gr. of sat. solution at 0° = 1.061; at 10°, 1.055; at 20° = 1.024.

The results of Sims are discussed and recalculated by Fulda, 1909.

1 gm. H_2O dissolves 0.0909 gm. SO_2 = 34.73 cc. (measured at 25°) at 25° and 760 mm. pressure. (Walden and Centnerszwer, 1902–03.)

FREEZING-POINT DATA FOR THE SYSTEM SULFUR DIOXIDE — WATER.

(Baume and Tykociner, 1914)

t° of Freezing.	Mols. SO_2 per 100 Mols. SO_2+H_2O.	Solid Phase.	t° of Freezing.	Mols. SO_2 per 100 Mols. SO_2+H_2O.	Solid Phase.
0	0	Ice	7.7	5.1	SO_2 Hydrate
−0.2	0.8	"	8.3	5.9	"
−3 Eutec.	...	" +SO_2 Hydrate	9.3	7.1	"
−0.2	2.8	SO_2 Hydrate	12.1	11	"
+3.5	3.3	"	⋮	⋮	⋮
6.8	5.5	"	12.2	95.1	"

At the temperature +12.1° and extending over the range of concentration 11 to 95.1 mols. per cent SO_2 a second phase rich in SO_2 separates. This crystallizes at −74° and the diagram is consequently composed of two lines parallel to the axis of concentration, the one at the +12.1° level corresponding to the SO_2 hydrate, and the other at the −74° level, to the SO_2 rich phase. The diagram is terminated by a very short branch rising from −74° to the temperature of solidification of pure SO_2 (−72.3°).

SOLUBILITY OF SULFUR DIOXIDE IN WATER AT DIFFERENT PRESSURES.

(Lindner, 1912.)

Results at 0°.		Results at 25°.		Results at 50°.	
Pressure in mm. Hg.	Gms. SO_2 per 100 cc. Sat. Sol.	Pressure in mm. Hg.	Gms. SO_2 per 100 cc Sat. Sol.	Pressure in mm. Hg.	Gms. SO_2 per 100 cc. Sat. Sol.
0.4	0.0537	1.4	0.0534	4.9	0.0525
3.5	0.237	11.75	0.234	30.5	0.2276
29.4	1.227	87.9	1.212	204.5	1.181
109.4	3.804	313	3.750	696	3.628

SOLUBILITY OF SULFUR DIOXIDE IN AQUEOUS SALT SOLUTIONS.

(Fox, 1902.)

Results in terms of the Ostwald Solubility Expression. See p. 227.

Aqueous Salt Solution.	Solubility Coefficient l of SO_2 in aq. Solutions of Concentrations: 0.5 Normal	1.0 N.	1.5 N.	2.0 N.	2.5 N.	3.0 N.
NH_4Cl	l_{25}=34.58	36.37	38.06	39.76	41.37	42.78
NH_4Br	l_{25}=36.25	39.46	42.78	46.06	49.17	52.25
NH_4CNS	l_{25}=37.78	42.74	47.26	52.26	57.01	61.46
NH_4NO_3	l_{25}=33.96	35.07	36.28	37.27	38.01	39.14
NH_4NO_3	l_{35}=23.35	24.23	24.78	25.57	26.66	27.43
$(NH_4)_2SO_4$	l_{25}=33.35	33.82	34.33	34.95	35.47	35.96
$(NH_4)_2SO_4$	l_{35}=22.91	23.14	23.49	23.93	24.23	24.60
$CdCl_2$	l_{25}=31.66	30.55	29.46	28.16	27.09	26.06
$CdCl_2$	l_{35}=21.73	21.23	20.55	20.02	19.23	18.68
$CdBr_2$	l_{25}=31.91	31.01	30.17	29.27	28.15	27.46
$CdBr_2$	l_{35}=21.88	21.46	20.81	20.60	19.70	19.17
CdI_2	l_{25}=33.27	33.76	34.16	34.74	34.98	35.77
CdI_2	l_{35}=22.75	23.06	23.36	23.71	23.99	24.30
$CdSO_4$	l_{25}=31.11	29.71	28.24	26.58	25.14	23.76
$CdSO_4$	l_{35}=21.45	20.43	19.42	18.31	17.41	16.25
KCl	l_{25}=34.42	36.05	37.76	39.32	40.96	42.27
KCl	l_{35}=23.74	25.15	26.54	27.94	28.93	30.02
KBr	l_{25}=35.94	39.11	42.41	44.96	48.87	52.26
KBr	l_{35}=24.83	27.49	29.64	31.93	34.12	36.14
KCNS	l_{25}=37.57	42.38	47.02	51.81	55.87	61.26
KCNS	l_{35}=25.63	28.79	32.03	35.05	38.13	42.94
KI	l_{25}=38.66	44.76	50.58	56.75	62.63	68.36
KI	l_{35}=26.30	30.25	34.64	38.04	41.87	45.43
KNO_3	l_{25}=33.80	34.79	35.77	36.66	37.57	38.52
KNO_3	l_{35}=23.27	24.03	24.79	25.72	26.54	27.33
K_2SO_4	l_{25}=33.20	33.61	...	...	...	...
NaBr	l_{25}=33.76	34.54	35.27	36.26	36.84	37.74
NaCl	l_{25}=32.46	32.25	31.96	31.76	31.51	31.36
NaCNS	l_{25}=35.44	38.24	40.78	43.37	45.86	48.34
Na_2SO_4	l_{25}=31.96	31.14	30.45	29.51	28.66	28.44
Na_2SO_4	l_{35}=21.88	21.35	20.81	20.21	19.75	19.27

The author also gives a series of determinations in which a mixture of $SO_2 + CO_2$ is used for saturating the solutions, thus changing the concentration of the SO_2 and yielding results for certain partial pressures of this gas.

Additional data for the solubility of sulfur dioxide in aqueous salt solutions are given by Walden and Centnerszwer (1902–03) but these authors present their results in terms of the difference between the amount of SO_2 dissolved in water and in the aqueous solution. The exact manner in which these calculations were made is not clearly explained.

SOLUBILITY OF SULFUR DIOXIDE IN SULFURIC ACID OF 1.84 SP. GR.

Interpolated from original results. (Dunn, 1882.)

t°.	Sp. Gr. of Sat. Solution.	Coefficient of Absorption (760 mm.).	t°.	Sp. Gr. of Sat. Solution.	Coefficient of Absorption (760 mm.)
0	...	53.0	50	1.8186	9.5
10	1.8232	35.0	60	1.8165	7.0
20	1.8225	25.0	70	1.8140	5.5
25	1.8221	21.0	80	1.8112	4.5
30	1.8216	18.0	90	1.8080	4.0
40	1.8205	13.0			

SOLUBILITY OF SULFUR DIOXIDE IN AQUEOUS SULFURIC ACID SOLUTIONS.

(Dunn; see also Kolb, 1872.)

t°.	Sp. Gr. of H_2SO_4 Solution.	Approximate Per cent H_2SO_4.	Coefficient of Absorption.	t°.	Sp. Gr. of H_2SO_4 Solution.	Approximate per cent H_2SO_4.	Coefficient of Absorption
6.9	1.139	20	48.67	15.2	1.173	25	31.82
6.9	1.300	40	45.38	16.8	1.151	21	31.56
8.6	1.482	58	39.91	14.8	1.277	36	30.41
9.8	1.703	78	29.03	15.1	1.458	56	29.87
5.5	1.067	10	36.78	15.6	1.609	70	25.17
6.0	1.102	15	3.408	15.0	1.739	81	20.83

For definition of Coefficient of Absorption, see Ethane p. 285.

SOLUBILITY OF SULFUR DIOXIDE IN ALCOHOLS AND IN OTHER SOLVENTS.

(de Bruyn, 1892; Schulze, 1881)

In Ethyl Alcohol at 760 mm.			In Methyl Alcohol at 760 mm.			In Several Solvents at 0° and 725 mm. (S.)		
t°.	Gms. SO_2 per 100 Gms. Solution.	Gms. SO_2 per 100 Gms. C_2H_5OH.	t°.	Gms. SO_2 per 100 Gms. Solution.	Gms. SO_2 per 100 Gms. CH_3OH.	Solvent.	SO_2 per 1 Gm. Solvent Grams.	SO_2 per 1 Gm. Solvent Vols.
0	53.5	115.0		71.1	246.0	Camphor	0.880	308
7	45.0	81.0		59.9	149.4	CH_3COOH	0.961	318
12.3	39.9	66.4		52.2	109.2	HCOOH	0.821	351
18.2	32.8	48.8	(17.8°)	44.0	78.6	$(CH_3)_2CO$	2.07	589
26.0	24 4	32.3		31.7	46.4	SO_2Cl_2	0.323	189

SOLUBILITY OF SULFUR DIOXIDE IN CHLOROFORM.

(Lindner, 1912.)

Results at 0°.		Results at 25°.	
Pressure in mm. Hg.	Gms. SO_2 per 100 cc Sat. Sol.	Pressure in mm. Hg.	Gms. SO_2 per 100 cc. Sat Sol.
2.7	0.0701	5.7	0.0669
5.6	0.1790	12.9	0.1712
22	0.6982	48	0.6728
90.2	3.097	200.2	2.954
219.6	8.217	488.8	7.839

Solubility of Sulfur Dioxide in Several Solvents.

(Lloyd, 1918.)

The dry, air free, SO_2 was passed through the solvent until saturation was reached and 5 cc. (usually) of the saturated solution were mixed with a large volume of water and titrated with standardized iodine solution.

t°.	Gms. SO_2 per Liter of Saturated Solution in: Benzene.	Nitrobenzene.	Toluene.	*o* Nitrotoluene.	Acetic Anhydride.
−5	...	...	...	...	196
0	...	...	...	...	148 (d = 1.22)
+5	...	...	...	...	136
10	...	...	...	...	122
15	...	311.4	...	290.8	114
20	...	267.4	217.5	236	106
25	...	227.9	170.4	192.2	99
30	127.5	190	124.4	160.7	90
40	82.9	132	93.6	118.5	...
50	60.3	98.7	77.2	87.2	...
60	34	78.6	54.7	68.8	...

Distribution of Sulphur Dioxide at 20° between:

(McCrae and Wilson, 1903.)

Water and Chloroform. Gms. SO_2 per Liter in: Aq. Layer.	CHCl$_3$ Layer.	Gm. Equiv $\frac{1}{2}SO_2$ per Liter in: Aq. Layer.	CHCl$_3$ Layer.	Conc. of HCl.	Aq. HCl and Chloroform. Gms. SO_2 per Liter in: Aq. Layer.	CHCl$_3$ Layer.	Gm. Equiv. $\frac{1}{2}SO_2$ per Liter in: Aq. Layer.	CHCl$_3$ Layer.
1.738	1.123	0.0543	0.0351	0.05	1.86	1.46	0.0581	0.0456
1.753	1.122	0.0547	0.0350	"	3.07	2.83	0.0960	0.0884
2.346	1.703	0.0732	0.0532	"	4.28	4.07	0.1336	0.1271
2.628	1.897	0.0821	0.0592	"	5.34	5.42	0.1667	0.1692
3.058	2.385	0.0955	0.0745	0.10	1.25	1.41	0.039	0.044
3.735	3.062	0.1166	0.0956	"	2.78	3.08	0.0868	0.0962
4.226	3.626	0.1319	0.1132	"	3.86	4.08	0.1199	0.1275
5.269	4.798	0.1645	0.1498	"	5.161	5.72	0.1612	0.1784
6.588	6.183	0.2057	0.1930	0.2	1.268	1.51	0.0396	0.0471
31.92	33.84	0.9968	1.056	"	1.914	2.27	0.0597	0.0710
33.26	37.25	1.038	1.163	"	2.464	3.04	0.0769	0.0949
				"	3.967	4.90	0.1239	0.1530
				0.4	1.202	1.61	0.038	0.0504
				"	1.894	2.26	0.059	0.0706

Freezing-point data for mixtures of sulfur dioxide and sulfuryl chloride (SO_2Cl_2) are given by van der Goot (1913).

SULFURIC ACID H_2SO_4 (Sulfur Trioxide, SO_3).

Solubility in Water.

(Landoldt and Börnstein, "Tabellen," 4th Ed, pp. 472–3, 1912.)

The available data for the freezing-points of mixtures of sulfuric acid and water have been plotted and the most probable values read from the curves. The data are also calculated to SO_3. The complete results are given on the following page.

Solubility of Sulfuric Acid in Water, Determined by the Freezing-point Method.

t°.	Gms. H_2SO_4 per 100 Gms. Sat. Sol.	Gms. SO_3 per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. H_2SO_4 per 100 Gms Sat. Sol.	Gms SO_3 per 100 Gms. Sat. Sol.	Solid Phase.
−10	16.25	13.25 (1)(5)	Ice	−10	77.75	63.5 (3)	$SO_3.2H_2O$
−20	24	19.5 (1)(2)(3)	"	0	80.25	65.5 (2)	"
−30	28.5	23.25 (2)	"	+8.35*	84.5	68.98 (2)	"
−40	31.25	25.5 (2)	"	8.81	84.5	68.98 (1)	"
−50	33.5	27.25 (1) (2)	"	0	88.25	72 (2)	"
−60	35.25	28.75 (1)	"	−20	91.5	74.75 (1)	"
−70	36.75	30 (2)	"	−30	92.5	75.5 (1)	"
−75	38	31 (2)	" +$SO_3.5H_2O$	−38	93	76 (2)	" +$SO_3.H_2O$
−70	39	31.75 (2)	$SO_3.5H_2O$	−30	93.75	76.5 (4)	$SO_3.H_2O$
−60	41.5	33.75 (2)	"	−20	95.25	77.75 (4)	"
−50	44	36 (2)	"	−10	96.25	78.5 (1)(4)	"
−40	47.75	39 (2)	"	0	97.75	79.75 (4)	"
−30	53.25	43.25 (2)	"	+10	99.75	81 (4)	"
−25*	57.65	47.06 (2)	"	10.35	100	81.62 (1)(3)(7)(4)	
−30	61	49.75 (2)	"	10	...	82 (4)	"
−40	65.25	53.25 (2)	"	0	...	83.25 (4)	"
−60	70.75	57.75 (3)	" (unstable)	−10	...	84.5 (4)	"
−70	73.25	59.75 (3)	" " +$SO_3.2H_2O$	−12	...	85 (4)	" +$SO_3.\frac{1}{2}H_2O$
−60	73.50	60 (3)	$SO_3.2H_2O$ (unstable)	−10	...	85.25 (4)	$SO_3.\frac{1}{2}H_2O$
−50	74.25	60.5 (3)	"	0	...	86 (4)	"
−50	68	55.5 (2)	$SO_3.5H_2O$+$SO_3.3H_2O$	+10	...	86.75 (4)	"
−45	68.5	56 (6)	$SO_3.3H_2O$	20	...	87.5 (4)	"
−40	71	58 (6)	"	30	...	88.5 (4)	"
−38.9*	73.14	59.69 (6)	"	36*	...	89.89 (4)	"
−40	74.25	60.5 (6)	"	30	...	90.5 (4)	"
−41	74.75	61 (6)	" +$SO_3.2H_2O$	20	...	91.5 (4)	"
−40	74.75	61 (4)	$SO_3.2H_2O$	10	...	92.25 (4)	"
−30	75.25	61.5 (4)	"	6.5	...	93 (4)	" +(?)
−20	76.5	62.5 (3)	"				

* m pt.

(1) = Pfaundler and Schnegg (1875); (2) = Pickering (1890); (3) = Thilo (1892); Pictet (1894); (4) = Knietsch (1901); (5) = Rüdorff (1862); (6) = Biron (1899), (7) = Marignac (1853). See also Pickering (1890–91); Lespieau (1894) and Giran (1913).

Solubility of Sulfuric Acid in Benzene Solutions of Valeric Acid at 18°.

(Gurwitsch, 1914)

The mixtures were shaken with excess of 95.8% H_2SO_4 at 0° and then brought to equilibrium at 18°.

Gms. Valeric Acid per 100 Gms Valeric Acid+Benzene.	Gms. H_2SO_4 per 100 Gms. of the Sat. Solution.
0 = Pure benzene	0
0.584	0.052
1.62	0.104
3.64	0.226
7.60	0.378
17.5	0.454

TANNIC ACID

When a sample of tannic acid of apparently very good quality was added to water at room temperature, the solution increased so greatly in viscosity, that even before the saturation point was reached, it became evident that a satisfactory separation of liquid and solid could not be made. The solubility in water is variously given in the pharmaceutical literature from about 20 to 300 gms. tannic acid per 100 gms. of water. Similarly, the quoted results for the solubility in alcohol vary from about 50 to 400 gms. acid per 100 gms. of alcohol. (Seidell, 1910.)

100 gms. glycerol dissolve 48.8 gms. tannin at 15–16°. (Ossenddwski, 1907.)

100 gms. trichlorethylene dissolve 0.012 gm. tannin at 15°. (Wester and Bruins, 1914.)

TANTALUM Potassium FLUORIDE TaK_2F_7.

SOLUBILITY IN AQUEOUS HYDROFLUORIC AND POTASSIUM FLUORIDE SOLUTIONS.

(Ruff and Schiller, 1911.)

The tantalum salt was purified by repeated crystallizations from pure anhydrous HFl. After drying at 120°, it was shaken in platinum flasks for 3 hour periods at constant temperature with HFl or KFl solutions or both together. The saturated solutions were filtered by means of a platinum funnel and subjected to analysis.

Mixture Shaken in Pt. Flask.	t°.	Gms per 100 Gms Sat. Sol. TaH_5.	KF.	HF.	Solid Phase.
$K_2TaF_7+H_2O$	18	0.25	0.12	0.020	$K_xTa_yO_zF_u+K_2TaF$
" +aq. 4.77%KF	18	0 10	4.79	0.074	"
" +aq. 7.35% KF	16	0.09	6.73	0.015	"
" +aq. 4.47% HF	18	1.33	0.56	4.47	K_2TaF_7
" +aq. 4.2 %HF	18.5	1.24	0 52	4.2	"
" +aq. 24.3%HF	18	5.35	2.25	24.3	"
" +aq. 10.44% HF+ 21.92% KF	18	0.036	21.93	10.44	"
" $+H_2O$	85	2.18	1.69	0 85	$K_xTa_yO_zF_u+K_2TaF_7$
" +aq. 4.77% KF	85	0.96	5.27	1.17	"
" +aq. 4.47% HF	90	5.73	2.41	4.47	K_2TaF_7
" +aq. 4.2% HF	90	6	2.52	4.2	"
" +aq. 23.3% HF	90	10.9	4.59	24.3	"
" +aq. 21.92% KF+ 10.44% HF	90	1.18	22.42	10.44	"

The solid phases were identified only by their crystal forms and it is possible that still others may be present.

TARTARIC ACIDS $C_2H_2(OH)_2(COOH)_2$. *d*, *l*, and *racemic*

SOLUBILITY OF EACH SEPARATELY IN WATER.

(Leidie, 1882.)

t°.	Grams Tartaric Acid per 100 Gms. H_2O. Dextro and Laevo Acids.	Racemic Ac. Anhydrous.	Racemic Ac. Hydrated.	t°.	Gms. Tartaric Acid per 100 Gms. H_2O. Dextro and Laevo Acids.	Racemic Ac. Anhydrous.	Racemic Ac. Hydrated
0	115.04	8.16	9.23	50	195.0	50.0	59.54
10	125.72	12.32	14.00	60	217.55	64.52	78.33
20	139.44	18.0	20.60	70	243.66	80.56	99.88
25	147.44	21.4	24.61	80	273.33	98.12	124.56
30	156.2	25.2	29.10	90	306.56	117.20	152.74
40	176.0	37.0	43.32	100	343.35	137.80	184.91

100 gms. H_2O dissolve 140.8 gms. tartaric acid at 15°. The Sp. Gr. of the sat. solution is 1.31. (Greenish and Smith, 1902.)

Solubility of Tartaric Acid in Alcohols.

(Timofeiew, 1894.)

Alcohol.	t°.	Gms. $C_2H_2(OH)_2(COOH)_2$ per 100 Gms. Solvent.	Alcohol.	t°.	Gms. $C_2H_2(OH)_2(COOH)_2$ per 100 Gms. Solvent.
Methyl Alcohol	− 3	67.5	Ethyl Alcohol	+23	28.9
"	+19.2	70.1	"	39	31.8
"	23	73.2	Propyl Alcohol	− 3	8.74
"	39	77.3	"	+19.2	10.85
Ethyl Alcohol	− 3	22.4	"	23	11.85
"	+19.2	27.6	"	39	14.4

Solubility of Tartaric Acid in Aqueous Ethyl Alcohol Solutions at 25°.

(Seidell, 1910.)

Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_2H_2(OH)_2(COOH)_2$ per 100 Gms. Sat. Sol.	Gms. $C_2H_2(OH)_2(COOH)_2$ per 100 Gms. Solvent.	Wt. Per cent C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $C_2H_2(OH)_2(COOH)_2$ per 100 Gms. Sat. Sol.	Gms. $C_2H_2(OH)_2(COOH)_2$ per 100 Gms. Solvent.
0	1.321	57.9	137.5	60	1.142	43.9	78.3
10	1.300	56	127.3	70	1.095	40.2	66.9
20	1.276	54.1	117.9	80	1.040	35.3	54.6
30	1.251	52	108.3	90	0.973	29	40.8
40	1.220	49.6	98.4	95	0.937	25.4	34.1
50	1.184	47	88.6	100	0.905	21.6	27.6

Solubility of Tartaric Acid in Several Solvents.

Solvent.	Sp. Gr. of Solvent.	d_{25} of Sat Sol	t°.	Gms $C_2H_2(OH)_2(COOH)_2$ per 100 Gms Solvent.	Authority.
Amyl Alcohol	$d_{20}=0.817$	0.824	25	3.50	(Seidell, 1910.)
Benzene	$d_{25}=0.873$	0.875	25	0.0086	"
Carbon Tetrachloride	$d_{25}=1.587$	1.589	25	0.0189	"
Ether	$d_{22}=0.711$	0.715	25	0.61	"
"	...	...	15	0.40	(Bourgoin, 1878.)
Dichlorethylene	...	...	15	0.005	(Wester & Bruins, '14.)
Trichlorethylene	...	...	15	0.005	"

Distribution of Tartaric Acid between Water and Ether.

(Pinnow, 1915.)

Results at 15°. H_2O Layer, c (Gms Mols per Liter)	Ether Layer, c' (Gms Mols per Liter)	$\frac{c}{c'}$.	Results at 27°. H_2O Layer, c (Gms Mols per Liter)	Ether Layer, c' (Gms Mols per Liter)	$\frac{c}{c'}$.
1.402	0.0072	197	1.625	0.0070	233
0.790	0.0037	216	0.857	0.0033	259
0.446	0.0022	210	0.427	0.0016	268

F.-pt. data are given for mixtures of the *d* and *racemic* modifications of dimethyl ether of tartaric acid, and for mixtures of the *d* and *racemic* modifications of dimethyl ether of diacetyl tartaric acid by Roozeboom (1899). Results for mixtures of the *d* and *i* forms of the diformalic derivative of *racemic* tartaric acid by Ringer (1902). Results for mixtures of *d* tartaric acid and *racemic* acid ester and for *d* diacetyl tartrate and *racemic* acid ester are given by Beck (1904). Data for mixtures of *d* and *l* tartaric acid and for mixtures of *d* and *i* dimethyl ester of tartaric acid are given by Centnerszwer (1899).

Pyro**TARTARIC ACID** (Methyl Succinic Acid) $CH_3.CH(COOH).CH_2(COOH)$.

100 gms. H_2O dissolve 51 gms. $CH_3CH(COOH).CH_2COOH$ at 19.5°. (Timofeiew, 1894.)

SOLUBILITY IN ALCOHOLS.
(Timofeiew, 1894.)

Alcohol.	t°.	Gms. Acid per 100 Gms. Solvent.	Alcohol.	t°.	Gms. Acid per 100 Gms. Solvent.
Methyl Alcohol	−18.5	53	Ethyl Alcohol	19.5	72.4
"	+19	109.8	Propyl Alcohol	19	44.9
"	+19.5	112.5	"	19.5	47.1
Ethyl Alcohol	+19	70.8			

100 gms. 95% formic acid dissolve 17.8 gms. pyrotartaric acid at 18.5°. (Aschan, 1913.)

TERPIN HYDRATE $C_{10}H_{18}(OH)_2.H_2O$.

100 cc. H_2O dissolve 0.36 gm. terpin hydrate at 15–20°.
100 cc. 90% alcohol dissolve 7.1 gms. terpin hydrate at 15–20°. (Squire and Caines, 1905.)

TELLURIUM Te.

100 gms. methylene iodide, CH_2I_2, dissolve 0.1 gm. Te at 12°. (Retgers, 1893.)

DISTRIBUTION OF TELLURIUM BETWEEN AQUEOUS HYDROCHLORIC ACID AND ETHER AT ROOM TEMPERATURE.
(Mylius, 1911.)

When 1 gm. of tellurium as the chloride, $TeCl_4$, is dissolved in 100 cc. of aqueous HCl and shaken with 100 cc. of ether, the following per cents of the metal enter the ethereal layers. With 20% HCl, 34 per cent; 15% HCl, 12 per cent; 10% HCl, 3 per cent; 5% HCl, 0.2 per cent and with 1% HCl, only a trace of the tellurium.

Fusion-point curves for mixtures of tellurium and each of the following metals are given by Pelabon (1909): Sb, Sn, Pb, Ag, Au and As. Results for mixtures of Te and Zn are given by Kobayashi (1911–12).

TELLURIC ACID $H_2TeO_4.2H_2O$.

SOLUBILITY IN WATER.
(Mylius, 1901.)

t°.	Gms. H_2TeO_4 per 100 Gms. Sol.	Mols. H_2TeO_4 per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. H_2TeO_4 per 100 Gms. Sol.	Mols. H_2TeO_4 per 100 Mols. H_2O.	Solid Phase.
0	13.92	1.51	$H_2TeO_4.6H_2O$	30	33.36	4.67	$H_2TeO_4.2H_2O$
5	17.84	2.03	"	40	36.38	5.33	"
10	26.21	3.31	"	60	43.67	7.04	"
15	31.79	4.55	"	80	51.55	9.93	"
10	25.29	3.15	$H_2TeO_4.2H_2O$	100	60.84	14.52	"
18	28.90	3.82	"	110	67	19	"

TELLURIUM DOUBLE SALTS

SOLUBILITY OF TELLURIUM DOUBLE BROMIDES AND CHLORIDES IN AQUEOUS HYDROCHLORIC AND HYDROBROMIC ACIDS AT 22°.
(Wheeler, 1893a.)

Tellurium Double Salt.	Formula.	Solvent.	Gms. Double Salt per 100 Gms. Solvent of 1.49 Sp. Gr.	of 1.08 Sp. Gr.
Te Caesium Bromide	$TeBr_4.2CsBr$	Aq. HBr	0.02	0.13
Te Potassium Bromide	$TeBr_4.2KBr$	"	6.57	62.90
Te Rubidium Bromide	$TeBr_4.2RbBr$	"	0.25	3.88
Te Caesium Chloride	$TeCl_4.2CsCl$	Aq. HCl*	0.05	0.78
Te Rubidium Chloride	$TeCl_4.2RbCl$	"	0.34	13.09

* Sp. Gr. of Aq. HCl solutions 1.2 and 1.05 respectively.

TELLURIUM TetraIODIDE TeI_4.

SOLUBILITY IN MIXTURES OF AQUEOUS HYDRIODIC ACID AND IODINE AT 25°.
(Menke, 1912.)

Weighed amounts of TeI_4 + I + 65 wt. % HI solution were shaken in sealed glass tubes for 10 days. Both the clear saturated solution and the solid phase were analyzed.

Composition of Original Mixture in Gms.			Gms. per 100 Gms. Solution		Solid Phase.
TeI_4.	I.	64% HI.	TeI_4.	I.	
3	1.5	19.25	12	11.7	Small amt. $TeI_4.HI.8H_2O$
2	0.5	9.61	13	0	much "
2	0.5	9.61	13.5	8.2	" "
3	3	8.99	20	21.8	small amt. "
Excess	None	5 (cc.)	9	0.19	$TeI_4.HI.8H_2O$
2	9	9.10	10	52.4	Iodine
4	10	9.27	15	47.7	"
3	7	9.02	17.5	47.9	"
None	Excess	5 (cc.)	None	61.1	"

THALLIUM ALUMS

SOLUBILITY IN WATER AT 25°.
(Locke, 1901.)

Alum.	Formula.	Salt per 100 Grams H_2O. Gms. Anhydrous.	Gms. Hydrated.	Gm. Mols.
Tl Aluminum Alum	$TlAl(SO_4)_2.12H_2O$	7.5	11.78	0.0177
Tl Vanadium Alum	$TlV(SO_4)_2.12H_2O$	25.6	43.31	0.0573
Tl Chromium Alum	$TlCr(SO_4)_2.12H_2O$	10.48	16.38	0.0212
Tl Iron Alum	$TlFe(SO_4)_2.12H_2O$	36.15	64.6	0.0799

See also pp. 31 and 32.

THALLIUM BROMATE $TlBrO_3$.

One liter saturated aqueous solution contains 3.463 gms. $TlBrO_3$ at 19.9° (Böttger, 1903) and 7.355 gms. at 39.75°. (Noyes and Abbot, 1895.)

THALLIUM BROMIDE TlBr.

One liter sat. aqueous solution contains 0.238 gm. TlBr at 0.13°, 0.289 gm. at 9.37°, 0.4233 gm. at 18° and 0.579 gm. at 25.68°. (Kohlrausch, 1908.)

SOLUBILITY OF THALLIUM BROMIDE IN AQUEOUS SOLUTIONS OF THALLIUM NITRATE AT 68.5°.
(Noyes, 1890.)

Gms Mols. per Liter		Gms per Liter.	
$TlNO_3$.	TlBr.	$TlNO_3$.	TlBr.
0	0.00869	0	2.469
0.0163	0.00410	4.336	1.164
0.0294	0.00289	7.820	0.821
0.0955	0.00148	25.400	0.420

F.-pt. data for mixtures of TlBr + TlCl, TlBr + TlI and TlCl + TlI are given by Mönkemeyer (1906). Results for TlCl + $SnCl_2$ and TlCl + $ZnCl_2$ are given by Korreng (1914).

THALLIUM CARBONATE Tl_2CO_3.

SOLUBILITY IN WATER.
(Crookes, 1864; Lamy, 1863.)

t°.	15.5°.	18°.	62°	100°.	100.8°?
Gms. Tl_2CO_3 per 100 gms. H_2O	4.2 (C.)	5.23	12.85	27.2 (C.)	22.4

THALLIUM CHLORATE $TlClO_3$.

SOLUBILITY IN WATER.

(Muir, 1876.)

t°.	0°.	20°.	50°.	80°.	100°.
Gms. $TlClO_3$ per 100 gms. H_2O	2	3.92	12.67	36.65	57.31

One liter sat. aq. solution contains 38.51 gms. $TlClO_3$ at 20°. (Noyes and Farrel, 1911.)

One liter of aqueous solution, saturated with both salts, contains 30.4 gms. $TlClO_3$ + 34.43 gms. Tl_2SO_4 at 20°. (Noyes and Farrel, 1911.)

SOLUBILITY OF MIXED CRYSTALS OF THALLIUM CHLORATE AND POTASSIUM CHLORATE IN WATER AT 10°.

(Roozeboom, 1891.)

NOTE. — Solutions of the two salts were mixed in different proportions and allowed to crystallize, such amounts being taken that not more than one or two grams would separate from one liter.

Gms. per 1000 cc. Solution.		Mg. Mols. per 1000 cc. Solution.		Sp. Gr. of Solutions.	Mols. per cent $KClO_3$ in Mixed Crystals.
$TlClO_3$.	$KClO_3$.	$TlClO_3$.	$KClO_3$.		
25.637	...	89.14	...	1.0210	0
19.637	6.884	68.27	56.15	1.0222	2
12.001	26.100	41.73	212.89	1.0278	12.61
9.036	40.064	31.42	326.79	1.0338	25.01
7.885	46.497	27.42	379.26	1.0359	36.30–97.93
7.935	46.535	27.60	379.57	1.0360	
6.706	46.410	23.32	378.55	1.0357	99.28
6.723	47.109	23.37	384.25	1.0363	99.60
4.858	47.312	16.89	385.91	1.0345	99.62
2.769	47.134	9.63	384.46	1.0330	99.67
...	49.925	...	407.22	1.0330	100

SOLUBILITY OF MIXED CRYSTALS OF THALLIUM CHLORATE AND POTASSIUM CHLORATE IN WATER AT DIFFERENT TEMPERATURES.

(Quoted by Rabe, 1902.)

100 gms. H_2O dissolve 2.8 gms. $TlClO_3$ + 3.3 gms. $KClO_3$ at 0°.
" H_2O dissolve 10 gms. $TlClO_3$ + 1.5 gms. $KClO_3$ at 15°.
" H_2O dissolve 12.67 gms. $TlClO_3$ + 16.2 gms. $KClO_3$ at 50°.
" H_2O dissolve 57.3 gms. $TlClO_3$ + 48.2 gms. $KClO_3$ at 100°.

THALLIUM PerCHLORATE $TlClO_4$.

SOLUBILITY IN WATER.

(Carlson, 1910.)

t°.	Sp. Gr. Sat. Sol.	Gms. $TlClO_4$ per 100 Gms. H_2O.	t°.	Sp. Gr. Sat. Sol.	Gms. $TlClO_4$ per 100 Gms. H_2O.
0	1.060	6	50	1.251	39.62
10	1.075	8.04	70	1.430	65.32
30	1.146	19.72	80	1.520	81.49

100 gms. H_2O dissolve 10 gms. $TlClO_4$ at 15° and 166.6 gms. at 100°. (Roscoe, 1866.)

THALLIUM CHLORIDE TlCl.

SOLUBILITY IN WATER.

(Average curve from results of Noyes, 1892; Böttger, 1903; Kohlrausch, 1904; Hebberling; Crookes; Lamy. The results of Berkeley, 1904 are also given.)

t°.	Gms. TlCl per Liter.		t°.	Gms. TlCl per Liter.		t°.	Gms. TlCl per Liter.	
0	2.1 (av.)	1.7 (B.)	25	3.86	4	60	8	10.2
10	2.5	2.4	30	4.2	4.6	80	12	16
20	3.3	3.4	40	5.2	6	100	18	24.1 (99.3°)
			50	6.3	8			

The results of Berkeley are in terms of gms. of TlCl per 1000 gms. H_2O but since the densities of the solutions are approximately 1 in all cases, except for temperatures above 60°, the differences are negligible. The Sp. Gr. of the sat. sol. at 99.3° is 0.9787 and the figure 24.1, therefore, becomes 23.58 gms. per liter.

One liter sat. solution in water contains 2.27 gms. TlCl at 9.54°, 3.05 gms. at 17.7°, and 3.97 gms. at 25.76°. (Kohlrausch, 1908.)

SOLUBILITY OF THALLIUM CHLORIDE AT 25° IN AQUEOUS SOLUTIONS OF:

Acetic Acid. (Hill, 1917.)

Normality of Aq. CH_3COOH.	TlCl per Liter. Gms.	Gm. Equiv.
0	3.8515	0.016085
0.0501	3.8375	0.016027
0.0958	3.8326	0.016006
0.263	3.7503	0.015662
0.524	3.6539	0.015258

Nitric Acid. (Hill and Simmons, 1909.)

Normality of Aq. HNO_3.	d_{25} of Sat Sol.	TlCl per Liter. Gms.	Gm. Equiv.
0	0.996	3.951	0.0165
0.4977	1.0184	5.937	2.475
1.0046	1.0359	6.882	2.875
2.0452	1.0705	8.143	3.401
4.0170	1.1362	9.925	4.145

SOLUBILITY OF THALLIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SALTS WITH A COMMON ION AT 25°.

(Noyes, 1892.)

Aqueous Solution of:	Gms. Equiv. Added Salt per Liter.	Gms Equiv. Dissolved TlCl per Liter.	Aqueous Solution of:	Gms. Equiv. Added Salt per Liter.	Gms. Equiv. Dissolved TlCl per Liter.
Water alone	0	0.01612	$MgCl_2$	0.025	0.00904
NH_4Cl	0.025	0.00877	"	0.050	0.00618
"	0.05	0.00593	"	0.10	0.00413
"	0.20	0.00271	"	0.20	0.00275
$BaCl_2$	0.05	0.00620	$MnCl_2$	0.025	0.00898
"	0.10	0.00425	"	0.05	0.00617
$CdCl_2$	0.025	0.01040	"	0.10	0.00412
"	0.05	0.00780	"	0.20	0.00286
"	0.10	0.00578	KCl	0.025	0.00872
"	0.20	0.00427	"	0.05	0.00593
$CaCl_2$	0.025	0.00899	"	0.10	0.00399
"	0.05	0.00624	"	0.20	0.00265
"	0.10	0.00417	"	0.80	0.00170
"	0.20	0.00284	NaCl	0.025	0.00869
$CuCl_2$	0.025	0.00905	"	0.05	0.00592
"	0.05	0.00614	"	0.10	0.00395
"	0.10	0.00422	"	0.20	0.00271
"	0.20	0.00291	$TlClO_3$	0.025	0.00897
HCl	0.025	0.00869	"	0.025	0.00894
"	0.05	0.00585	$TlNO_3$	0.025	0.00883
"	0.10	0.00384	"	0.05	0.00626
"	0.20	0.00254	"	0.10	0.00423

SOLUBILITY OF THALLIUM CHLORIDE IN AQUEOUS SALT SOLUTIONS AT 25°.

(Noyes, 1890; Noyes and Abbott, 1895; Geffcken, 1904.)

Aq. Salt Solution.	G. Mols. per Liter.		Gms. per Liter.	
	Salt.	TlCl.	Salt.	TlCl.
Ammonium Nitrate NH_4NO_3	0	0.01612	0	3.861 (G.)
"	0.5	0.02587	40.02	6.209
"	1	0.03121	80.05	7.473
"	2	0.03966	160.10	9.497
Barium Chloride $BaCl_2$	0.0283	0.00857	5.895	2.052 (N.)
"	0.1468	0.00323	30.59	0.773
Cadmium Sulfate $CdSO_4$	0.030	0.0206	6.255	4.933 (N.)
"	0.0787	0.0254	16.41	6.081
"	0.1574	0.0309	32.82	7.399
Hydrochloric Acid HCl	0.0283	0.00836	1.032	2.002 (N.)
"	0.0560	0.00565	2.043	1.353
"	0.1468	0.00316	5.357	0.757
Lithium Nitrate $LiNO_3$	0.5	0.02542	34.53	6.085 (G.)
"	1	0.03035	69.07	7.266
"	2	0.03785	138.14	9.063
"	3	0.04438	207.21	10.630
Potassium Chlorate $KClO_3$	0.5	0.0237	61.28	5.674 (G.)
Potassium Nitrate KNO_3	0.015	0.0170	1.517	4.070 (N.)
"	0.030	0.0179	3.033	4.286
"	0.0787	0.0192	7.775	4.597
"	0.1574	0.0212	15.920	5.076
"	0.5	0.0257	50.55	6.153 (G.)
"	1	0.0308	101.11	7.375
"	2	0.0390	202.22	9.340
Sodium Acetate CH_3COONa	0.015	0.0168	1.231	4.023 (N.)
"	0.030	0.0172	2.462	4.118
"	0.0787	0.0185	6.46	4.430
"	0.1574	0.0196	12.92	4.693
Sodium Nitrate $NaNO_3$	0.5	0.02564	42.50	6.139 (G.)
"	1	0.03054	85.01	7.313
"	2	0.03851	170.02	9.221
"	3	0.04544	255.03	10.88
"	4	0.05128	340.12	12.28
Sodium Chlorate $NaClO_3$	0.5	0.02320	53.25	5.555 (G.)
"	1	0.02687	106.5	6.433
"	2	0.03060	213	7.326
"	3	0.03303	319.5	7.909
"	4	0.03850	426	9.215
Thallium Bromate $TlBrO_3$ (at 39.75°)	0.01567	0.01959	5.201	4.690 (N. & A.)
Thallium Nitrate $TlNO_3$	0.0283	0.0083	7.518	1.987 (N.)
"	0.0560	0.00571	14.89	1.368
"	0.1468	0.00332	39.05	0.795
Thallium Sulfate Tl_2SO_4	0.0283	0.00886	14.27	2.121 (N.)
"	0.0560	0.00624	28.23	1.494
Thallium Thiocyanate TlSCN	0.0107	0.0119	2.802	2.849 (N.)
" (at 39.75°)	0.02149	0.01807	5.632	4.326 (N. & A.)

NOTE. — In the case of the results for thallium bromate and thallium thiocyanate at 39.75°, the solutions were saturated with respect to these salts as well as with respect to thallium chloride.

SOLUBILITY OF THALLIUM CHLORIDE IN AQUEOUS SOLUTIONS OF SALTS AT 25°

(Bray and Winninghoff, 1911.)

Solvent.			Saturated Solution.		
Salt Present.	Gms Equiv. Salt. per Liter.	d_{25} of Aq. Solvent.	Gms. Equiv. Salt per Liter.	d_{25} of Sat. Sol.	Gms. Equiv. TlCl per Liter.
None	...	...	...	0.9994	0.01607
KNO_3	0.02001	0.9973	0.020	1.0009	0.01716
"	0.05000	0.9992	0.04997	1.0028	0.01826
"	0.10005	1.0023	0.09998	1.0063	0.01961
"	0.3002	1.0145	0.3000	1.0194	0.02313
"	1.0005	1.0568	0.9996	1.0632	0.03072
K_2SO_4	0.01997	0.9975	0.01996	1.0012	0.01779
"	0.05000	0.9995	0.04996	1.0037	0.01942
"	0.1000	1.0030	0.09989	1.0074	0.02137
"	0.3000	1.0167	0.29966	1 0221	0.02600
"	1	1.0628	0.9986	1.0698	0.03416
Tl_2SO_4	0.0200	1.0007	0.01999	1 0028	0.01034
"	0.0500	1.0076	0.04999	1.0090	0.006772
"	0.1000	1.0191	0.09997	1.0200	0.004679

One liter of water dissolves 2.7 gms. *thallo thallic chloride* $3TlCl.TlCl_3$ at 15°-17°, and 35 gms. at 100°. (Crookes, 1864; Lamy; Hebberling.)

THALLIUM CHROMATE Tl_2CrO_4.

100 gms. H_2O dissolve 0.03 gm. Tl_2CrO_4 at 60°, and 0.2 gm. at 100°. (Browning and Hutchins, 1900.)

One liter of aq. 31 per cent KOH solution dissolves 18 gms. Tl_2CrO_4. (Lepierre and Lachand, 1891.)

One liter of H_2O dissolves 0.35 gm. thallium trichromate, $Tl_2Cr_3O_{10}$, at 15°, and 2.27 gms. at 100°. (Crookes, 1864.)

THALLIUM CYANIDE TlCN and Double Cyanides.

SOLUBILITY IN WATER.

(Fronmüller, 1878.)

Cyanide.	Formula.	Gms. Salt per 100 Gms. H_2O.
Tl Cyanide	TlCN	16.8 at 28.5°.
Tl Cobalti Cyanide	$Tl_3Co(CN)_6$	3.6 at 0°; 5.86 at 9.5°; 10.04 at 19.5°.
Tl Zinc Cyanide	$2TlCN.Zn(CN)_2$	8.7 at 0°; 15.2 at 14°; 29.6 at 31°.
Tl Ferro Cyanide	$Tl_4Fe(CN)_6.2H_2O$	0.37 at 18°; 3.93 at 101°. (Lamy.)

THALLIUM FLUORIDE TlF.

100 gms. H_2O dissolve 80 gms. TlF at 15°. (Büchner, 1865.)

THALLIUM HYDROXIDE TlOH.

SOLUBILITY IN WATER.

(Bahr, 1911.)

t°.	d_{25} of Sat. Sol.	Mols. TlOH per Liter.	Gms. TlOH per Liter.	t°.	Mols. TlOH per Liter.	Gms. TlOH per Liter.
0	1.231	1.151	254.4	44.5	2.442	539.8
18.5	1.317	1.554	343.4	54.1	2.940	649.7
29	1.342	1.803	398.5	64.6	3.601	795.8
32.1	1.377	1.861	411.2	78.5	4.673	1033
36	1.417	2.075	458.6	90	5.705	1261
40	1.446	2.240	495	99.2	6.708	1483

The solutions were stirred by means of a current of hydrogen. The solid phase is the same at all temperatures.

THALLIUM IODATE $TlIO_3$.

One liter aq. solution contains 0.578 gm. $TlIO_3$ at 20°. (Böttger, 1903.)

One liter aqueous solution contains $1.76 . 10^{-4}$ mols. $TlIO_3$ at 25° = 0.667 gm., determined by means of electrodes of the third kind. (Spencer, 1912.)

THALLIUM IODIDE TlI

One liter sat. solution in water contains 0.0362 gm. at 9.9°, 0.056 gm. at 18.1° and 0.0847 gm. at 26°. (Kohlrausch, 1908.)

SOLUBILITY OF THALLIUM IODIDE IN WATER.

(Average results from Böttger, 1903; Kohlrausch, 1904–05; Werther; Crookes, 1864; Lamy; Hebberling.)

t°.	0°.	20°.	40°.	60°.	80°.	100°.
Gms. TlI per liter	0.02	0.06	0.15	0.35	0.70	1.20

One liter of 2½ per cent aq. ammonia dissolves 0.761 gm. TlCl.

One liter of 6½ per cent aq. ammonia dissolves 0.758 gm. TlCl.

One liter of 90 per cent alcohol dissolves 0.0038 gm. TlCl.

One liter of 50 per cent alcohol dissolves 0.027 gm. TlCl. (Long, 1888.)

Data for the temperatures of solidification of mixtures of TlI and $TlNO_3$ are given by Van Eyk (1901).

THALLIUM NITRATE $TlNO_3$.

SOLUBILITY IN WATER.

(Berkeley, 1904; see also Etard, 1894; Crookes; Lamy.)

t°.	Gms. $TlNO_3$ per 100 Gms. Solution.	Gms. $TlNO_3$ per 100 Gms. Water.	t°.	Gms. $TlNO_3$ per 100 Gms. Solution.	Gms. $TlNO_3$ per 100 Gms. Water.
0	3.76	3.91	60	31.55	46.2
10	5.86	6.22	70	41.01	69.5
20	8.72	9.55	80	52.6	111.0
30	12.51	14.3	90	66.66	200.0
40	17.33	20.9	100	80.54	414.0
50	23.33	30.4	105	85.59	594.0

Solid phase. $TlNO_3$ rhombic.

100 gms. H_2O dissolve 43.5 gms. $TlNO_3$ + 104.2 gms. KNO_3 at 58°. (Rabe, 1902.)

THALLIUM OXALATE $Tl_2C_2O_4$

One liter of saturated aqueous solution contains 15.77 gms. $Tl_2C_2O_4$ at 20°, and 18.69 gms. at 25°. (Böttger, 1903; Abegg and Spencer, 1905.)

SOLUBILITY OF THALLIUM OXALATE AT 25° IN AQ. SOLUTIONS OF:

Thallium Nitrate. (Abegg and Spencer.) Mol. Concentration. $TlNO_3$.	Mol. Concentration. $Tl_2C_2O_4$.	Grams per Liter. $TlNO_3$.	Grams per Liter. $Tl_2C_2O_4$.	Potassium Oxalate. (Abegg and Spencer.) Mol. Concentration. $K_2C_2O_4$.	Mol. Concentration. $Tl_2C_2O_4$.	Grams per Liter. $K_2C_2O_4$.	Grams per Liter. $Tl_2C_2O_4$.
0.0	0.03768	0.00	18.69	0.0498	0.0351	8.281	17.42
0.04114	0.0264	10.95	13.10	0.0996	0.03565	16.57	17.69
0.0799	0.0195	21.26	9.68	0.2467	0.0390	41.02	19.36
0.1597	0.01235	42.51	6.128	0.4886	0.04506	81.25	22.37
				0.9785	0.05536	162.6	27.48

THALLIUM PHOSPHATE (ortho) Tl_3PO_4.

One liter of sat. aqueous solution contains 4.97 gms. Tl_3PO_4 at 15° and 6.71 gms. at 100°. (Crookes, 1864.)

THALLIUM PICRATE $TlOC_6H_2(NO_2)_3$.

SOLUBILITY IN WATER.
(Rabe, 1901.)

t°.	Gms. $TlOC_6H_2(NO_2)_3$ per 100 Gms. H_2O.	Solid Phase.	t°.	Gms. $TlOC_6H_2(NO_2)_3$ per 100 Gms. H_2O.	Solid Phase.
0	0.135	Monoclinic Red	45	1.04	Triclinic Yellow
18	0.36	"	47	1.10	"
30	0.575	"	50	1.205	"
40	0.825	"	60	1.73	"
47	1.14	"	70	2.43	"

100 gms. H_2O simultaneously sat. with both salts dissolve:

0.132 gm. $C_6H_2(NO_2)_3OTl$ + 0.36 gm. $C_6H_2(NO_2)_3OK$ at 0°.
0.352 " " + 0.44 " " " 15°.
0.38 " " + 0.23 " " " 20°. (Rabe, 1901.)

SOLUBILITY OF THALLIUM PICRATE IN METHYL ALCOHOL.
(Rabe, 1901.)

t°.	Gms. $TlOC_6H_2(NO_2)_3$ per 100 Gms. CH_3OH.	Solid Phase.	t°.	Gms. $TlOC_6H_2(NO_2)_3$ per 100 Gms. CH_3OH.	Solid Phase.
0	0.39	Red Form (monoclinic)	45	1.195	Yellow Form (triclinic)
18	0.59	"	48	1.265	"
25	0.70	"	50	1.325	"
30	0.795	"	53	1.41	"
35	0.90	"	57	1.54	"
40	1.02	"	60	1.65	"
45	1.17	"	65	1.84	"
47	1.265	"			

THALLIUM SELENATE Tl_2SeO_4.

SOLUBILITY IN WATER.

t°.	Gms. Tl_2SeO_4 per 100 Gms. H_2O.	Authority.
9.3	2.13	(Tutton, 1907.)
12	2.4	"
20	2.8	(Glauser, 1910.)
80	8.5	"
100	10.86	(Tutton, 1907.)

THALLIUM SULFATE Tl_2SO_4.

SOLUBILITY IN WATER.
(Berkeley, 1904; see also Crookes; Lamy.)

t°.	Gms. Tl_2SO_4 per 100 Gms.		t°.	Gms. Tl_2SO_4 per 100 Gms.	
	Solution.	Water.		Solution.	Water.
0	2.63	2.70	60	9.89	10.92
10	3.57	3.70	70	11.31	12.74
20	4.64	4.87	80	12.77	14.61
30	5.80	6.16	90	14.19	16.53
50	8.44	9.21	99.7	15.57	18.45

100 gms. H_2O dissolve 3.36 gms. Tl_2SO_4 at 6.5°, 4.3 gms. at 12° and 19.14 gms. at 100°. (Tutton, 1907.)

One liter sat. solution in water contains 48.59 gms. Tl_2SO_4 at 20° (Noyes and Farrel, 1911) and 54.59 gms. at 25° (Noyes and Stewart, 1911).

100 gms. H_2O simultaneously sat. with both salts dissolve:

4.74 gms. Tl_2SO_4 + 10.3 gms. K_2SO_4 at 15°.
11.5 " " + 16.4 " " 62°.
18.52 " " + 26.2 " " 100°. (Rabe, 1902.)

SOLUBILITY OF THALLIUM SULFATE IN AQUEOUS SOLUTIONS AT 25°.

(Noyes and Stewart, 1911.)

Solvent.		Saturated Solution.				
Salt Present.	Formula Wts. Salt per Liter.	Formula Wts. Salt per Liter.	Formula Wts. Tl_2SO_4 per Liter.	d_{25} of Sat. Sol.	Gms. Salt per Liter.	Gms. Tl_2SO_4 per Liter.
$TlNO_3$	0.099±	0.0996	0.08365	...	26.51	42.17
Na_2SO_4	0.04995	0.0497	0.1080	1.0531	7.062	54.44
"	0.20	0.1988	0.1173	1.0754	28.25	59.13
$NaHSO_4$	0.1015	0.1010	0.1161	1.0596	12.12	58.53
H_2SO_4	0.04967	0.0494	0.1172	1.0540	4.878	59.09
"	0.09933	0.0987	0.1249	1.0604	9.747	62.95

SOLUBILITY OF THALLIUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°.

(D'Ans and Fritsche, 1909.)

Mols. per 1000 Gms. Sat. Sol. H_2SO_4.	Tl_2SO_4.	Solid Phase.	Mols. per 1000 Gms. Sat. Sol. H_2SO_4.	Tl_2SO_4.	Solid Phase.
0	0.103	Tl_2SO_4	4.89	0.59	$TlHSO_4$
2.99	0.46	" $+Tl_3H(SO_4)_2$	4.92	0.66	"
4.25	0.61	$Tl_3H(SO_4)_2+TlHSO_4$	4.78	0.75	"
4.55	0.56	$TlHSO_4$	4.26	1.01	"
4.79	0.55	"	4.03	1.08	"

THALLIUM DOUBLE SULFATES

SOLUBILITY IN WATER AT 25°.

(Locke, 1901.)

Double Sulfate.	Formula.	Salt per 100 cc. H_2O Gms. Anhydrous.	Gms. Mols.
Tl Copper Sulfate	$Tl_2Cu(SO_4)_2.6H_2O$	8.1	0.0122
Tl Nickel Sulfate	$Tl_2Ni(SO_4)_2.6H_2O$	4.61	0.007
Tl Zinc Sulfate	$Tl_2Zn(SO_4)_2.6H_2O$	8.6	0.0129

THALLIUM SULFIDE Tl_2S.

One liter of sat. aqueous solution contains 0.215 gm. Tl_2S at 20°. (Böttger, 1903.)

A diagram and discussion of the fusion points of $Tl_2S + S$, $Tl_2S + Se$ and $Tl_2S + Te$ are given by Pelabon, 1907.

THALLIUM SULFITE Tl_2SO_3.

100 gms. H_2O dissolve 3.34 gms. Tl_2SO_3 at 15.5°. (Seubert and Elten, 1892.)

THALLIUM THIOCYANATE TlSCN.

SOLUBILITY IN WATER AND IN AQUEOUS SALT SOLUTIONS.

(Böttger, 1903; Noyes, 1890; Noyes and Abbott, 1895.)

One liter sat. aq. solution contains 3.154 gms. TlSCN at 20°, 3.905 gms. at 25°, and 7.269 gms. at 39.75°.

Aq. Salt Solution.	t°.	Gms. Mols. per Liter. Salt.	TlSCN.	Gms. per Liter. Salt.	TlSCN.
Thallium Bromate $TlBrO_3$ (excess)	39.75	0.01496	0.0221	4.966	5.793 (N. & A.)
Thallium Nitrate $TlNO_3$	25	0.0227	0.00852	6.04	2.233 (N.)
"	25	0.0822	0.00406	21.88	1.064
Potassium Thiocyanate, KSCN	25	0.0227	0.0083	2.208	2.176 (N.)

THALLIUM VANADATES.

SOLUBILITY IN WATER. (Carnelly, 1873; Liebig, 1860.)

Vanadate.	Formula.	Gms. Vanadate per 100 Gms. H_2O. At 15°.	At 100°.
Tl. meta vanadate	$TlVO_3$	0.087 (11°)	0.21
" ortho vanadate	Tl_3VO_3	1	1.74
" pyro vanadate	$Tl_4V_2O_7$	0.20 (14°)	0.26
" vanadate	$Tl_{12}V_8O_{28}$	0.107	0.29

THEBAINE (Para Morphine) $C_{19}H_{21}NO_3$.

SOLUBILITY IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. Thebaine per 100 Gms. Solvent.	Authority.
92 Wt. % Alcohol	25	0.1	...
Ether	10	0.71	...
Aniline	20	30	(Scholtz, 1912.)
Pyridine	20	9	"
Piperidine	20	2	"
Diethylamine	20	0.7	

THEOBROMINE (Dimethyl Xanthine) $C_5H_2(CH_3)_2N_4O_2$.

SOLUBILITY IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms $C_5H_2(CH_3)_2N_4O_2$ per 100 Gms. Solvent.	Authority.
Water	18	0.0305	(Paul, 1901.)
"	15–20	0 059	(Squire & Caines, 1905.)
Aq. 0.25 *n* HCl	18	0.047	(Paul, 1901.)
" 1 *n* HCl	18	0.083	"
" 0.1 *n* NaOH	18	1.78	"
" 0.25 *n* "	18	4 56	"
" 15.6 per cent $Na_3(PO_4)_2$.Sol.	15	3.69	(Brissemoret, 1898.)
92.3 Wt. % Alcohol	21	0 045	(Squire & Caines, 1905.)
90 Wt. % Alcohol	15–20	0 02	"
Dichlorethylene	15	0.005	(Wester & Bruins, 1914.)
Trichlorethylene	15	0.008	"
Carbon Tetrachloride	b. pt.	0.0214	(Gockel, 1897.)
Ether	b. pt.	0.032	"

THIOPHENE MonoCARBONIC ACIDS α, β and a C_4H_3SCOOH.

The solubility of the three isomers is given by Voerman (1907) as 0.57 gm. of the α acid per 100 cc. sat. solution at 21°; 0.445 gm. of the β acid at 18°, and 0.75 gm. of the a acid at 17°. The solvent is not stated. Data for the solidification points of mixtures of the α and β acid are also given.

THEOPHYLLINE (Theocin) $C_5H_2(CH_3)_2N_4O_2.H_2O$.

100 gms. H_2O dissolve 0.52 gm. theophylline at 15–20°. (Squire & Caines, 1905.)
100 cc. 90 vol. % alcohol dissolve 1.25 gms. theophylline at 15–20°. " "

THORIUM EMANATIONS.

Data for the solubility of thorium emanations are given by Klaus (1905).

THORIUM ChloroACETATES.

SOLUBILITY IN WATER AT 25°. (Karl, 1910.)

Name of Salt.	Formula.	Gms. Salt per 100 Gms. H_2O.
Basic Thorium Monochloroacetate	$(ClCH_2COO)_2Th(OH)_2.H_2O$	0.0663
Basic Thorium Dichloroacetate	$(Cl_2CHCOO)_2Th(OH)_2$	0.0887
Basic Thorium Trichloroacetate	$(Cl_3C.COO)_2Th(OH)_2$	0.0091

THORIUM BORATE.

The precipitate which results when thorium nitrate is added to a solution of borax is not a stable compound. Solubility determinations made by four successive extractions of it at 18° with water, gave the following gms. of material per 100 gms. H_2O; 0.5366, 0.1250, 0.0611 and 0.0560. After the fourth extraction, the residue then contained 10.14% B_2O_3 and after boiling 10 gms. with 100 cc. of H_2O for 6 hrs. and repeating this four times, it contained 9.63–9.81% B_2O_3. (Karl, 1910.)

THORIUM HIPPURATE $Th(C_6H_5.CO.CH_2.NH.COO)_4$.

100 gms. H_2O dissolve 0.0318 gm. of the salt at 25°. (Karl, 1910.)

THORIUM OXALATE $Th(C_2O_4)_2.6H_2O$.

SOLUBILITY IN AQUEOUS SOLUTIONS OF AMMONIUM OXALATE AT 25°.
(Hauser and Wirth, 1909a, 1912.)

Gm. Mols. per 1000 Gms. Sat. Sol. $(NH_4)_2C_2O_4$.	Gm. Mols. per 1000 Gms. Sat. Sol. $Th(C_2O_4)_2$.	Solid Phase.	Normality of Aq. $(NH_4)_2C_2O_4$	Gms. ThO_2 per 1000 Gms. Sat. Sol.	Solid Phase.
0.00033	0.00005	$Th(C_2O_4)_2.6H_2O$	0.01	0.040	$Th(C_2O_4)_2.6H_2O$
0.00072	0.00012	"	0.10	2.203	"
0.00120	0.000208	"	0.5*	7.660	$[Th_2(C_2O_4)_5](NH_4)_2.7H_2O$
0.00153	0.00026	"	0.5*	10.63	"
0.601†	0.195	$[Th(C_2O_4)_3](NH_4)_2.3H_2O$	0.5*	15.90	"
1.181†	0.427	"	0.5*	17.60	"
1.420†	0.540	"	0.5*	17.75	"
1.480†	0.563	"			

* In these cases the greater part of the ammonium salt entered the solid phase complex and it was, therefore, necessary to add additional ammonium oxalate until constant results were obtained.
† In these cases the solvent was saturated ammonium oxalate solutions containing an excess of the crystals.

A thorium ammonium oxalate of the composition $Th(C_2O_4.NH_4)_4.4H_2O$ is described by Brauner (1898). It is partially hydrolytically decomposed in aqueous solution and a solubility determination made by analyzing the solution from which the nearly pure salt began to crystallize, showed that 100 gms. H_2O contain 90.3 gms. $Th(C_2O_4.NH_4)_4.4H_2O$ and 9.3 gms. of $(NH_4)_2C_2O_4$ (= an additional ½ mol. wt.)

SOLUBILITY OF THORIUM OXALATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID.

Results at 17° (Colani, 1913.) Gms. per 100 Gms. Sat. Sol. HCl.	$Th(C_2O_4)_2$.	Results at 25° (Hauser and Wirth, 1912.) Conc. of Aq. HCl in Per cent.	Gm. ThO_2 per 1000 Gms. Sat. Sol.	Solid Phase.	Results at 50° (Colani, 1913.) Gms. per 100 Gms. Sat. Sol. HCl.	$Th(C_2O_4)_2$.
0	0.0017	24.8	0.100	$3Th(C_2O_4)_2.ThCl_4.2H_2O$	0	0.0017
1.2	0.0035	37	3.450	"	4.1	0.010
3.6	0.0061	37.6	3.492	"	8.4	0.028
4.6	0.0094				12.4	0.057
8.4	0.017				16.1	0.103
13.1	0.028				18	0.134
16.2	0.038				19.9	0.169
19.8	0.064				21.6	0.232

Data are also given for the solubility of thorium oxalate in aqueous solutions of mixtures of hydrochloric and oxalic acids at the above temperatures.

SOLUBILITY OF THORIUM CHLOROOXALATE, $3Th(C_2O_4)_2ThCl_4.2H_2O$, IN AQUEOUS HYDROCHLORIC ACID.

(Colani, 1913.)

t°.	Gms. per 100 Gms. Sat. Sol. HCl.	Gms. per 100 Gms. Sat. Sol. $Th_4(C_2O_4)Cl_4$.	t°.	Gms. per 100 Gms. Sat. Sol. HCl.	Gms. per 100 Gms. Sat. Sol. $Th_4(C_2O_4)_2Cl_4$.
12	23	0.12	50	21.2	0.29
15	26.3	0.17	50	23	0.34
12	29.9	0.27	50	26.8	0.46
15	32.5	0.48	50	29.8	0.75
12	33.1	0.53	50	32.3	1.51
15	35	1.03	50	34.6	2.59

Results are also given showing the effect of oxalic acid upon the solubility of the above salt in aqueous hydrochloric acid.

SOLUBILITY OF THORIUM OXALATE IN AQUEOUS OXALIC ACID SOLUTIONS.

Results at 25°.
(Hauser and Wirth, 1912.)

Normality of Aq. $H_2C_2O_4$.	Gm. ThO_2 per 1000 Gms. Sat. Sol.	Solid Phase.
1	0.0015	$Th(C_2O_4)_2.6H_2O$
Sat. Solution	0.0030	" $+H_2C_2O_4.2H_2O$

Results at 50°.
(Colani, 1913.)

Gms. per 100 Gms Sat. Sol. $H_2C_2O_4$.	Gms. per 100 Gms Sat. Sol. Th.
1.7	0.0002
9.3	0.001
03	0.003

SOLUBILITY OF THORIUM OXALATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID AT 25°.

(Hauser and Wirth, 1909a, 1912; Wirth, 1912.)

Normality of Aq. H_2SO_4.	Gms. ThO_2 per 1000 Gms. Sat. Sol.	Solid Phase.	Normality of Aq. H_2SO_4.	Gms. ThO_2 per 1000 Gms. Sat. Sol.	Solid Phase.
0.25	0.07	$Th(C_2O_4)_2.6H_2O$	4.32	1.10	$Th(C_2O_4)_2.6H_2O$
0.5	0.14	"	4.9	1.32	"
1	0.26	"	6.175	1.513	"
2.1	0.418	"	6.885	1.794	"
3.2	0.71	"	8.45	2.473	"

THORIUM PICRATE $Th(C_6H_2N_3O_7)_4.10H_2O$.

100 gms. H_2O dissolve 0.3052 gm. of the salt at 25°. (Karl, 1910.)

THORIUM SELENATE $Th(SeO_4)_2.9H_2O$.

100 gms. H_2O dissolve 0.498 gm. $Th(SeO_4)_4$ at 0° and 1.972 gms. at 100°. (Cleve, 1885.)

THORIUM SULFATE $Th(SO_4)_2$.

SOLUBILITY IN WATER.

(Roozeboom, 1890; Demarcay, 1883.)

t°.	Gms. $Th(SO_4)_2$ per 100 Gms. H_2O.		Solid Phase.	t°.	Gms. $Th(SO_4)_2$ per 100 Gms. H_2O.		Solid Phase.
0	0.74 (R)	0.88(D)	$Th(SO_4)_2.9H_2O$	0	1.50(R)		$Th(SO_4)_2.6H_2O$
10	0.98	1.02	"	15	1.63		"
20	1.38	1.25	"	30	2.45		"
30	1.995	1.85	"	45	3.85		"
40	2.998	2.83	"	60	6.64		"
50	5.22(51°)	4.86	"	17	9.41 (D)		$Th(SO_4)_2.4H_2O$
55	6.76	6.5±	"	40	4.04(R)	4.5 (35° D)	
0	1.0		$Th(SO_4)_2.8H_2$	50	2.54	1.94 (55°)	"
15	1.38			60	1.63	...	"
25	1.85		"	70	1.09	1.32 (75°)	"
44	3.71		"	95	...	0.71	"

Additional results for the $.8H_2O$ and the $.9H_2O$ salt, in fair agreement with the above, are given by Wyrouboff (1901).

SOLUBILITY OF THORIUM SULFATE IN AQUEOUS SOLUTIONS OF:

Ammonium Sulfate at 16°. (Barre, 1911.) — Lithium Sulfate at 25°. (Barre, 1912.)

Gms. per 100 Gms. H_2O: $(NH_4)_2SO_4$	Gms. per 100 Gms. H_2O: $Th(SO_4)_2$	Solid Phase.	Gms. per 100 Gms. H_2O: Li_2SO_4	Gms. per 100 Gms. H_2O: $Th(SO_4)_2$
2.13	3.361	$Th(SO_4)_2.9H_2O$	0	1.722
4.80	5.269	"	2.57	4.13
10.02	8.947	"	4.93	6.20
16.56	13.330	" +1.1.4	6.98	7.95
28	10.359	1.1.4	9.23	9.68
35.20	9.821	" +1.2.2	11.13	11.05
45.14	6.592	1.2.2	13.18	12.54
49.05	5.750	"	16.12	14.52
52.88	4.583	1.3.3	20.49	16.92
69.74	1.653	"	25.18	18.87

1.1.4 = $Th(SO_4)_2.(NH_4)_2SO_4.4H_2O$; 1.2.2 = $Th(SO_4)_2.2(NH_4)_2SO_4.2H_2O$; 1.3.3 = $Th(SO_4)_2.3(NH_4)_2SO_4.3H_2O$.

SOLUBILITY OF THORIUM SULFATE IN AQUEOUS SOLUTIONS OF POTASSIUM SULFATE.

(Barre, 1911.)

Results at 16°. Gms per 100 Gms. H_2O: K_2SO_4	Results at 16°. Gms per 100 Gms. H_2O: $Th(SO_4)_2$	Solid Phase.	Results at 75°. Gms. per 100 Gms. H_2O: K_2SO_4	Results at 75°. Gms. per 100 Gms. H_2O: $Th(SO_4)_2$
0	1.39	$Th(SO_4)_2 9H_2O$	0	0.9248
0.424	1.667	$Th(SO_4)_2.K_2SO_4.4H_2O$	0.865	1.137
1.004	2.193	"	1.167	1.173
1.152	3.191	"	1.172	1.121
1.224	2.514	"	1.270	0.907
1.283	2.222	"	1.296	0.495
1.348	1.706	"	1.852	0.297
1.378	1.637	$Th(SO_4)_2.2K_2SO_4.2H_2O$	3.117	0.201
1.487	0.870	"	4.659	0.256
1.844	0.370	"	5.348	0.170
3.092	0.070	"	5.932	0.123
4 050	0.027	$Th(SO_4)_2.3\frac{1}{2}K_2SO_4$	7.177	0.031
4.825	0.003	"	9.706	0.022

SOLUBILITY OF THORIUM SULFATE IN AQUEOUS SOLUTIONS OF HYDROCHLORIC ACID AND OF NITRIC ACID AT 30°.

(Koppel and Holtkamp, 1910.)

In Aq. Hydrochloric Acid. Wt. % HCl in Solvent.	Gms. $Th(SO_4)_2$ per 100 Gms. Sat. Sol.	Solid Phase.	In Aq. Nitric Acid. Wt. % HNO_3 in Solvent.	Gms. $Th(SO_4)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
0	2.15	$Th(SO_4)_2.8H_2O$	0	2.15	$Th(SO_4)_2.8H_2O$
4.55	3.541	"	5.17	3.68	"
6.95	3.431	"	10.04	4.20	"
12.14	2.811	"	16.68	4.84	"
15.71	2.360	"	21.99	4.47	"
18.33	2.199	"	28.33	3.96	"
20	2.110	$Th(SO_4)_2.4H_2O$	28.51	3.88	"
20	2.141	"	33.17	3.34	$Th(SO_4)_2.4H_2O$
23.9	1.277	"	38.82	2.51	"

SOLUBILITY OF THORIUM SULFATE IN AQUEOUS SOLUTIONS OF:

Sodium Sulfate at 16°. (Barre, 1910, 1911.) — Sulfuric Acid at 25°. (Barre, 1912.)

Gms. per 100 Gms. H_2O: Na_2SO_4	Gms. per 100 Gms. H_2O: $Th(SO_4)_2$	Solid Phase.	Gms per 100 Gms. H_2O: H_2SO_4	Gms per 100 Gms. H_2O: $Th(SO_4)_2$
1.094	1.743	$Th(SO_4)_2.Na_2SO_4.6H_2O$	0	1.722
1.960	2.387	"	1.072	1.919
2.98	3.962	"	1.941	2.017
4.11	3.375	"	2.821	2.060
5.79	2.136	"	3.843	2.061
9.35	1.379	"	5.212	2.035
12.24	1.169	"	8.055	1.863
15.36	1.048	"	10.105	1.702

SOLUBILITY OF THORIUM SULFATE IN AQUEOUS SOLUTIONS OF SULFURIC ACID

Results at 25°. (Wirth, 1912.) — Results at 20° and at the b.-pt. (Koppel and Holtkamp 1910)

Normality of Aq. H_2SO_4.	Gms. $Th(SO_4)_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Wt. % H_2SO_4 in Solvent.	Gms. $Th(SO_4)_2$ per 100 Gms. Sat Sol.	Solid Phase.
0	1.593	$Th(SO_4)_2.9H_2O$	20	5	1.722	$Th(SO_4)_2.8H_2O$
1.1	1.831	"	20	15	0.9752	"
2.16	1.488	"	20	25	0.3838	"
4.32	0.8751	"	20	40	0.0103	$Th(SO_4)_2.4H_2O$
6.68	0.4312	"	b. pt.	5	0.7407	$Th(SO_4)_2.8H_2O$
9.68	0.1045	$Th(SO_4)_2.8H_2O$	"	10	0.4808	"
10.89	0.0636	"	"	15	0.3882	"
15.15	0.0308	$Th(SO_4)_2.4H_2O$				

Results at 30°. (Koppel and Holtkamp, 1910.)

Wt. % H_2SO_4 in Solvent.	Gms. $Th(SO_4)_2$ per 100 Gms. Sat. Sol.	Solid Phase.	Wt. % H_2SO_4 in Solvent.	Gms. $Th(SO_4)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
0	2.152	$Th(SO_4)_2.8H_2O$	15.03	1.484	$Th(SO_4)_2.8H_2O$
0.466	2.055	"	23.64	0.7196	"
0.72	2.085	"	32.68	0.3364	"
1.468	2.267	"	37.80	0.077	$Th(SO_4)_2.4H_2O$
2.983	2.311	"	43.28	0.0213	"
4.38	2.367	"	45.69	0.0047	"
4.97	2.323	"	74	0.1208	"
9.95	1.961	"	80.5	0	"

THORIUM *m* Nitrobenzene **SULFONATE** $Th(C_6H_4.NO_2.SO_3)_4.7H_2O$.

100 gms. H_2O dissolve 61 gms. of the anhydrous salt at 15°. (Holmberg, 1907.)

THULIUM OXALATE $Tm_2(C_2O_4)_3.9H_2O(?.10H_2O)$.

100 cc. aq. 20% methyl amine oxalate dissolve approx. 4.082 gms. thulium oxalate.
100 cc. aq. 20% ethylamine oxalate dissolve approx. 5.728 gms. thulium oxalate.
100 cc. aq. 20% triethylamine oxalate dissolve approx. 1.340 gms. thulium oxalate. (Grant and James, 1917.)

THULIUM Bromonitrobenzene **SULFONATE** $Tm(C_6H_3Br.NO_2.SO_3, 1.4.2)_3.12H_2O$.

100 gms. sat. solution in water contain 6.379 gms. of the anhydrous salt at 25°. (Katz and James, 1913.)

THYMOL (3 Methyl 6 Isopropyl Phenol) $C_3H_7.C_6H_3.OH.CH_3$.

SOLUBILITY IN WATER. (Seidell, 1912.)

t°.	Gms. Thymol per 100 Gms. Sat. Sol.	t°.	Gms. Thymol per 100 Gms Sat Sol.	t°.	Gms. Thymol per 100 Gms. Sat. Sol.
10	0.067	25	0.0995	37	0.132 ($d_{37}=1$)
15	0.077	30	0.112	40	0.141
20	0.088	35	0.126		

SOLUBILITY OF THYMOL IN AQUEOUS HYDROCHLORIC ACID. (Seidell, 1912.)

Normality of Aq. HCl.	Gm. Thymol per 100 cc. Sat. Sol. at: 25°.		37.2°.
0	0.0995		0.132
0.1	0.0968	(d_{25} = 1.002)	0.129
0.5	0.0884	(d_{25} = 1.009)	0.121
1	0.0802	(d_{25} = 1.018)	0.112
2.5	0.0612	(d_{25} = 1.043)	0.0935
5	0.0445		0.0772 (d_{25} = 1.081)

100 cc. 90 vol. per cent alcohol dissolve about 300 gms. of thymol at 15°-20°. (Squire and Caines, 1905.)

SOLUBILITY OF THYMOL IN SEVERAL OILS. (Seidell, 1912.)

t°.	Gms. Thymol per 100 Gms. of: Olive Oil.	Peanut Oil.	Cod Liver Oil.	Liquid Petrolatum.	Castor Oil.	Cottonseed Oil.	Linseed Oil.
10	46.2	73	50	3.1	81.2	56.2	62.3
15	50.1	73.8	52	3.95	90.2	64	63.1
20	56.2	74.6	55.5	5.6	101.5	74.2	65.1
25	66.9	76.4	63.1	9.78	116.5	89.4	69
30	84.5	83.2	77	16.3	137	113.7	78.3
35	111	106.7	102	25.5	165	146.5	100
37	124.3	130.5	116.5	29.9	180	166.5	116.5
40	151.9	212.5	150	38.9	213	217.5	152

The specific gravities of the above saturated solutions and of solutions of lower concentrations of thymol in the several oils are also given.

DISTRIBUTION OF THYMOL BETWEEN WATER AND OILS AT 25° AND AT 37°. (Seidell, 1912.)

t°.	Water + Olive Oil. Gms. Thymol per 100 cc. Oil Layer (c_0).	H₂O Layer (c_w).	$\frac{c_0}{c_w}$.	Water + Cod Liver Oil. Gms. Thymol per 100 cc. Oil Layer (c_0)	H_2O Layer (c_w).	$\frac{c_0}{c_w}$.	Water + Peanut Oil. Gms. Thymol per 100 cc. Oil Layer (c_0).	H_2O Layer (c_w).	$\frac{c_0}{c_w}$.
25	0.1014	44.95	443	0.1079	49	454	0.1077	46.48	431
25	0.0848	36.34	428	0.0816	32.58	400	0.0786	32.45	413
25	0.0349	16.26	465	0.0371	16.18	436	0.0395	16.16	409
25	0.0106	4.54	430	0.0127	4.57	359	0.0088(?)	4.63	523
37	0.1087	46.35	427	0.1099	43.81	399			
37	0.0807	33.48	415	0.0862	32.90	380			
37	0.0381	16.24	426	0.0574	22.51	392			
37	0.0122	4.61	378	0.0250	8.86	357			

Freezing-point data for mixtures of thymol and sulfuric acid are given by Kendall and Carpenter (1914).

Results for thymol + bromotoluene are given by Paterno and Ampola (1897).

TIN Sn.

DISTRIBUTION OF TIN BETWEEN AQUEOUS HYDROCHLORIC ACID AND ETHER AT ROOM TEMPERATURE. (Mylius, 1911.)

When 1 gm. of tin as the chloride, $SnCl_4$, is dissolved in 100 cc. of aqueous hydrochloric acid and shaken with 100 cc. of ether, the following per cents of the metal enter the ethereal layers. With 20% HCl, 17 per cent; with 15% HCl, 28 per cent; with 10% HCl, 23 per cent; with 5% HCl, 10 per cent and with 1% HCl, 0.8 per cent of the tin.

TIN CHLORIDE (Stannous) $SnCl_2$.

100 gms. H_2O dissolve 83.9 gms. $SnCl_2$ at 0° and 269.8 gms. at 15°. Sp. Gr. of Solutions 1.532 and 1.827 respectively. (Engel, 1889; Michel and Krafft, 1851.)

SOLUBILITY OF STANNOUS CHLORIDE IN AQUEOUS SOLUTIONS OF HYDROCHLORIDE ACID AT 0°.

(Engel.)

Milligram Mols. per 10 cc. Solution.		Sp. Gr. of Solution.	Grams per 100 cc. Solution.	
HCl.	½$SnCl_2$.		HCl.	$SnCl_2$.
0	74.0	1.532	0.0	70.26
6.6	66.7	1.489	2.405	63.33
13.54	63.75	1.472	4.935	60.52
24.8	68.4	1.524	9.04	64.95
34.9	81.2	1.625	12.72	77.11
40.0	94.2	1.724	14.58	89.45
44.0	117.6	1.883	16.04	111.7
49.4	147.6	2.114	18.01	138.6
66.0	156.4	2.190	24.05	148.5
78.0	157.0	2.199	28.43	149.0

100 gms. acetone dissolve 55.6 gms. $SnCl_2$ at 18°. (d_{18} = 1.6.) (Naumann, 1904.)

100 gms. ether dissolve 11.4 gms. $SnCl_2.2H_2O$ at 0°–35.5°.

100 gms. ethyl acetate dissolve 31.2 gms. $SnCl_2.2H_2O$ at −2°, 35.53 gms. at +22° and 73.44 gms. at 82°. (von Laszynski, 1894.)

100 gms. ethyl acetate dissolve 4.46 gms. $SnCl_2$ at 18°. d_{18} of the sat. solution = 0.9215. (Naumann, 1910.)

100 gms. 95 per cent formic acid dissolve 4.1 gms. $SnCl_2$ at 19°. (Aschan, 1913.)

Freezing-point data for mixtures of $SnCl_2$ + $ZnCl_2$ are given by Herrmann (1911).

TIN CHLORIDE (Stannic) $SnCl_4$.

DISTRIBUTION OF STANNIC CHLORIDE BETWEEN WATER AND XYLENE.

(Smirnoff, 1907.)

Very concentrated aqueous stannic chloride solutions were agitated with xylene at various temperatures and the amount of $SnCl_4$, in terms of Cl, which entered the xylene layer was determined. The amount of Sn and Cl in the xylene was found to correspond to $SnCl_4$.

Results for Xylene + $SnCl_4.5H_2O$.

t°.	Gms. Cl per 100 Gms. Aq. Layer, c.	Gms. Cl per 100 Gms. Xylene Layer, c'.	$\frac{c}{c'}$.
66	40.35	0.08	504.4
80	39.95	0.18	228.5
97.5	40.24	0.33	122.1
111	40.27	0.68	59.3

Per cent Cl in $SnCl_4.5H_2O$ = 40.38.

Results for Xylene + $SnCl_4.4H_2O$.

t°.	Gms. Cl per 100 Gms. Aq. Layer, c.	Gms. Cl per 100 Gms. Xylene Layer, c'.	$\frac{c}{c'}$.
66	41.9	0.92	45.3
80	41.91	1.56	27
100	41.85	2.52	16.7
111	41.68	3.23	12.9

Per cent Cl in $SnCl_4.4H_2O$ = 42.37.

Results for Xylene + $SnCl_4.3H_2O$.

t°.	Gms. Cl per 100 Gms. Aq Layer, c.	Gms. Cl per 100 Gms. Xylene Layer, c'.	$\frac{c}{c'}$.
80	43.2	9.93	4.4
94	42.54	9.32	4.6
100	42.64	10.56	4.1
111	42.31	10.03	4.2

Per cent Cl in $SnCl_4.3H_2O$ = 45.12.

TIN HYDROXIDE (Stannous) $Sn(OH)_2$.

One liter of the saturated solution in water contains 0.0000135 gm. mols. $Sn(OH)_2$ at 25°. (Goldschmidt and Eckhardt, 1906.)

SOLUBILITY OF STANNOUS HYDROXIDE IN AQUEOUS SODIUM HYDROXIDE SOLUTIONS AT 25°.

(Goldschmidt and Eckhardt, 1906.)

The authors desired to ascertain whether the mono, $NaHSnO_2$, or the disodium salt, Na_2SnO_2, predominates in alkaline tin hydroxide solutions. Given amounts of carefully prepared tin chloride, made from tin and HCl, and sodium hydroxide solutions were mixed in vessels containing hydrogen. The mixtures were shaken at 25° and the clear supernatant solutions in contact with the precipitated $Sn(OH)_2$, analyzed.

Gm. Mols. per Liter.			Gm. Mols. per Liter.		
Total Na.	$NaHSnO_2$.	NaOH.	Total Na.	$NaHSnO_2$.	NaOH.
0.00451	0.0009845	0.003525	0.02250	0.00838	0.01412
0.00680	0.00218	0.00462	0.02788	0.01038	0.01755
0.01149	0.003495	0.007995	0.02940	0.00874	0.02066
0.02143	0.006935	0.014495	0.03012	0.00865	0.02147
0.02143	0.00660	0.01483	0.03036	0.01082	0.01954
0.02186	0.00628	0.015575	0.03044	0.009405	0.021035

SOLUBILITY IN AQUEOUS SODIUM HYDROXIDE SOLUTIONS. MOIST TIN HYDROXIDE USED. ORDINARY TEMPERATURE.

(Rubenbauer, 1902.)

Gms. per 20 cc. Solution.		Mol. Dilution of the NaOH.	Gms. per 20 cc. Solution.		Mol. Dilution of the NaOH.
Na.	Sn.		Na.	Sn.	
0.2480	0.1904	1.86	0.8326	0.5560	0.55
0.3680	0.2614	1.25	0.9661	0.7849	0.48
0.6394	0.4304	0.72	2.1234	1.8934	0.23

TIN IODIDE (Stannous) SnI_2.

SOLUBILITY IN WATER AND IN AQUEOUS HYDRIODIC ACID.

(Young, 1897.)

t°.	Gms. SnI_2 per 100 Gms. Aqueous HI Solutions of:							
	0% = H_2O.	5.83%.	9.60%.	15.2%.	20.44%.	24.8%.	30.4%.	36.82%.
20	0.98	0.20	0.23	0.60	1.81	4.20	10.86	25.31
30	1.16	0.23	0.23	0.64	1.81	4.06	10.28	23.46
40	1.40	0.33	0.28	0.71	1.90	4.12	10.06	23.15
50	1.69	0.46	0.38	0.82	2.12	4.34	10.35	23.76
60	2.07	0.66	0.55	1.11	2.51	4.78	11.03	24.64
70	2.48	0.91	0.80	1.37	2.92	5.43	11.97	25.72
80	2.95	1.23	1.13	1.83	3.70	6.38	13.30	27.23
90	3.46	1.65	1.52	2.40	4.58	7.82	15.52	29.84
100	4.03	2.23	2.04	3.63	5.82	9.60	...	34.05

TIN IODIDE (Stannic) SnI_4.

SOLUBILITY IN ORGANIC SOLVENTS.

(McDermott, 1911.)

Solvent.	t°.	Sp. Gr. Sat. Sol.	Gms. SnI_4 per 100 Gms. Sat. Sol.
Carbon Tetrachloride	22.4	1.59	5.25
"	50	1.63	12.50
Chloroform	28	1.50	8.21
Benzene	20.2	0.95	12.65

SOLUBILITY OF STANNIC IODIDE IN CARBON DISULFIDE.
(Sneider, 1866; Arctowski, 1895-'96.)

	−114°.5.	−94°.	−89°.	−84°.	−58°.	Ord. temp.
Gms. SnI_4 per 100 Gms. Solution	9.41	10.65	9.68	10.22	16.27	59.2(S)

100 gms. methylene iodide, CH_2I_2, dissolve 22.9 gms. SnI_4 at 10°. Sp. Gr. of solution = 3.481. (Retgers, 1893.)

TIN OXALATE (Stannous) $Sn(COO)_2$.

100 gms. 95 per cent formic acid dissolve 0.16 gm. $Sn(COO)_2$ at 19°. (Aschan, 1913.)

TIN Tetra**PHENYL** (Stannic) $Sn(C_6H_5)_4$.

Freezing-point data for $Sn(C_6H_5)_4 + Si(C_6H_5)_4$ are given by Pascal (1912).

TIN SULFATE (Stannous) $SnSO_4$.

100 gms. H_2O dissolve 18.8 gms. $SnSO_4$ at 19° and 18.1 gms. at 100°. (Marignac.)

TOLUENE $C_6H_5CH_3$.

SOLUBILITY IN SULFUR.

Figures read from curve, synthetic method used, see Note, page 16. (Alexejew, 1886.)

t°.	Gms. $C_6H_5CH_3$ per 100 Gms. S Layer.	Toluene Layer.	t°.	Gms. $C_6H_5CH_3$ per 100 Gms. S Layer.	Toluene Layer.
100	3	73	150	12.5	59
110	4	71	160	16	53
120	5	68	170	22	47
130	7	66	175	25	43
140	9.5	63	178 crit. temp.	34	

Nitro**TOLUENE** *o* $C_6H_4.CH_3.NO_2$.

RECIPROCAL SOLUBILITY OF *o* NITROTOLUENE AND WATER.
(Campetti and Delgrosso, 1913.)

The original results were plotted and the following figures read from the curve.

t°.	Gms. *o* Nitrotoluene per 100 Gms. H_2O Rich Layer.	Nitrotoluene Rich Layer.	t°.	Gms. *o* Nitrotoluene per 100 Gms. H_2O Rich Layer.	Nitrotoluene Rich Layer.
150	1	98	245	13	81
175	1.5	96	250	16	78
200	3	93	255	20	72
225	6.5	89	260	29	63
240	10.5	84	263.5 crit. t.	43	

100 gms. 95 per cent formic acid dissolve 13.25 gms. *p* $C_6H_4.CH_3.NO_2$ at 20.8°. (Aschan, 1913.)

Trinitro**TOLUENE** 2,4,6 $C_6H_2.CH_3(NO_2)_3$.

100 gms. H_2O dissolve 0.021 gm. $C_6H_2.CH_3(NO_2)_3$ at 15° and 0.164 gm. at 100°.
100 gms. alcohol dissolve 1.6 gms. $C_6H_2CH_3(NO_2)_3$ at 22° and 10 gms. at 58°. (Capisarow, 1915.)

TOLUENE SULFONAMINES *o*, *m* and *p*.

SOLUBILITY OF EACH IN WATER AT 25°. (Holleman and Caland (1911.)

Compound.	Gms. Comp'd per Liter Sat. Sol.
Amine of *o* Toluene Sulfonic Acid	1.624
" " *m* " " "	7.812
" " *p* " " "	3.156

FREEZING-POINT DATA (Solubility, see footnote, p. 1), FOR MIXTURES OF SUBSTITUTED TOLUENES AND OTHER COMPOUNDS.

Mixture.	Authority.
o Bromotoluene + *p* Bromotoluene	(van der Laan, 1907.)
Bromotoluene + *p* Xylene	(Paterno and Ampola, 1897.)
" + Veratrol	" "
" + Tribenzylamine	" "
p Nitrotoluene + α Ortho Nitrotoluene	(Holleman, 1914.)
" + β " "	"
" + 2, 4 Dinitrotoluene	(Giua, 1914, 1915.)
" + 2, 6 "	(Giua, 1915.)
" + 2, 4, 6 "	"
" + *m* Nitrotoluene	(Holleman and van den Arend, 1909.)
" + Urethan	(Mascarelli, 1908, 1909.)
2, 4 Dinitrotoluene + 2, 6 Dinitrotoluene	(Giua, 1914, 1915.)
" + 2, 4, 6 Trinitrotoluene	(Giua, 1915.)
2, 6 " + " "	(Giua, 1914, 1915.)
α Trinitrotoluene + *p* Amino Acetophenone	(Giua, 1916)
" + γ Trinitrotoluene	(Giua, 1915)
o Toluene Sulfochloride + *p* Toluene Sulfochloride	(Holleman and Caland, 1911.)
Binary Mixtures of Isomeric Tribromotoluenes	(Jaeger, 1904.)
" " " " Chloronitrotoluenes	(Wibaut, 1913; Holleman and van den Arend, 1909.)

TOLUIC ACIDS (Monomethyl Benzoic Acids) $CH_3.C_6H_4COOH$.

SOLUBILITY IN WATER AT 25°.

(Paul, 1894.)

Acid.	$CH_3.C_6H_4.COOH$ per Liter Solution. Grams.	Millimols.
Meta Toluic Acid	0.9801	7.207
Ortho Toluic Acid	1.1816	8.683
Para Toluic Acid	0.3454	2.540

One liter sat. solution in water contains 0.42 gram *p* toluic acid at 25°. One liter sat. solution in 1 *n* aq. sodium *p* toluate contains 0.735 gm. *p* toluic acid at 25°. (Sidgwick, 1910.)

SOLUBILITY OF TOLUIC ACIDS (EACH SEPARATELY) IN WATER AT VARIOUS TEMPERATURES.

(Sidgwick, Spurrell and Davies, 1915.)

The determinations were made by the synthetic method, see p. 16; melting-point of *o* toluic acid = 102.4°, of *m* acid = 110.5° and of *p* acid = 176.8°. The triple point (solid phase present) for the *o* acid, is at 93.5° and the concentration of acid in the two layers is 2.5 and 91.2 gms. respectively per 100 gms. sat. solution. The tr. pt. for the *m* acid is at 91.8° and concentrations are 1.6 and 90.5; the tr.-pt. for the *p* acid is at 142° and concentrations, 5 and 74.

t°.	Gms. per 100 Gms. Sat. Sol. *o* Toluic Acid.	*m* Toluic Acid.	*p* Toluic Acid.	t°.	Gms. per 100 Gms. Sat. Sol. *o* Toluic Acid.	*m* Toluic Acid.	*p* Toluic Acid.
80	2.03*	1.16*	...	140	9.25	5.77	4.30*
90	2.42*	1.54	...	150	13.7	8.40	9.33
100	2.97	1.98	1.16*	159.1 crit t.	...	...	∞
110	3.71	2.52	1.36*	160	30	19.4	
120	5.10	3.24	1.75*	161.1 crit. t.	∞	...	
130	6.93	4.30	2.50*	162.2 crit. t.	...	∞	

* Indicates that a solid phase is present.

Additional data for the solubility of the above compounds in water, determined by the synthetic method, are given by Flaschner and Rankin (1910).

RATIO OF THE SOLUBILITIES OF TOLUIC ACIDS (SEPARATELY DETERMINED) IN WATER AND IN OLIVE OIL AT 25°.
(Boeseken and Waterman, 1911, 1912.)

The solubilities of each acid in water and in olive oil was separately determined and the ratio considered to correspond to the distribution coefficients in each case. The concentrations of the dissolved acids are not given.

Acid.	Ratio of $\frac{\text{Solubility in Olive Oil}}{\text{Solubility in Water}}$.
o Toluic Acid	40.5
m " "	21
p " "	29.5

100 gms. 95% formic acid dissolve 2.99 gms. *o* toluic acid at 20.8°. (Aschan, 1913.)

Freezing-point data for mixtures of *o*, *m*, *p* and *α* toluic acids (each separately) and sulfuric acid are given by Kendall and Carpenter (1914). Results for mixtures of *o*, *m* and *α* acids and picric acid are given by Kendall (1916).

TOLUIDINE $C_6H_4CH_3.NH_2$.

SOLUBILITY IN WATER.
(Vaubel, 1895; Lowenherz, 1898.)

t°.	Gms. $C_6H_4CH_3NH_2$ per 1000 Gms. H_2O.	Solid Phase.	t°.	Gms. $C_6H_4CH_3NH_2$ per 1000 Gms H_2O.	Solid Phase.
20	16.26	Liquid ortho T.	20.8	7.39	Para T.
20	0.15	Ortho T.	26.7	9.50	"
20	6.54	Para T.	31.7	11.42	"

One liter sat. solution in water contains 15 gms. *o* toluidine at 25°.

One liter sat. solution in 1 *n* aq. *o* toluidine hydrochloride, contains 30 gms. *o* toluidine at 25°. (Sidgwick, 1910.)

The following results for *p* toluidine, differing considerably from the above, are given by Walker (1890).

t°.	22°	30°	36.7°	44°	57.5°	69°
Gms. *p* Toluidine per 100 Gms. Sat. Sol. in Water	19.6	26.9	35.4	44.5	51.4	58.9

SOLUBILITY OF PARA TOLUIDINE IN ETHYL ALCOHOL.
(Interpolated from original results of Speyers, 1902.)

t°.	Wt. of 1 cc. Solution.	Mols. per 100 Mols. C_2H_5OH.	Gms. per 100 Gms. C_2H_5OH.	t°.	Wt. of 1 cc. Solution.	Mols. per 100 Mols. C_2H_5OH.	Gms. per 100 Gms. C_2H_5OH.
0	0.8885	20.72	48.1	20	0.9265	47.0	110.0
5	0.8982	26.0	60.0	25	0.9360	56.0	132.0
10	0.9080	32.0	74.0	30	0.9460	66.0	156.0
15	0.9180	38.6	90.0				

100 gms. pyridine dissolve 126 gms. *p* toluidine at 20°–25°. (Dehn, 1917.)

100 gms. aq. 50% pyridine dissolve 96.1 gms. *p* toluidine at 20°–25°. "

DISTRIBUTION OF PARA TOLUIDINE BETWEEN WATER AND CARBON TETRACHLORIDE.
(Vaubel, 1903.)

Gms. *p* Toluidine Used.	Volumes of Solvents.	Gms. $C_6H_4(CH_3)NH_2$ *p* in: H_2O Layer.	CCl_4 Layer.
1	200 cc. H_2O+100 cc. CCl_4	0.1406	0.8594
1	200 cc. H_2O+200 cc. CCl_4	0.0666	0.9334

DISTRIBUTION OF *o*, *m* AND *p* TOLUIDINE BETWEEN WATER AND BENZENE AT 25°.

(Farmer and Warth, 1904.)

Base.	Dist. Coef. $\frac{\text{Conc. in } C_6H_6}{\text{Conc. in } H_2O}$.
o Toluidine	13.4
m "	19.1
p "	24.1

Aceto **TOLUIDINE** *p* $CH_3C_6H_4NH.C_2H_3O$.

SOLUBILITY IN MIXTURES OF ALCOHOL AND WATER AT 25°.

(Holleman and Antusch, 1894.)

Vol. % Alcohol.	Gms. per 100 Gms. Solvent.	Sp. Gr. of Solutions.	Vol. % Alcohol.	Gms. per 100 Gms. Solvent.	Sp. Gr. of Solutions.
100	10.18	0.8074	50	1.92	0.9306
95	10.79	0.8276	45	1.41	0.9380
90	10.62	0.8440	40	0.96	0.9460
85	9.62	0.8576	35	0.66	0.9544
80	8.43	0.8685	25	0.31	0.9668
75	7.04	0.8803	20	0.23	0.9725
70	5.81	0.8904	15	0.16	0.9780
65	4.39	0.9021	5	0.13	0.9903
60	3.59	0.9115	0	0.12	0.9979
55	2.69	0.9207			

See remarks under α acetnaphthalide, p. 13.

TRIPHENYLAMINE, TRIPHENYLPHOSPHINE, etc.

F.-pt. data are given by Pascal (1912) for the following mixtures:

Triphenylamine + Triphenylarsine
Triphenylamine + Triphenylphosphine
Triphenylarsine + Triphenylphosphine
Triphenylarsine + Triphenyl Stibene
Triphenylarsine + Triphenylbismuthine
Triphenylphosphine + "

α and β **TRITHIOACETALDEHYDE,** $(CH_3CHS)_3$.

α and β **TRITHIOBENZALDEHYDE,** $(C_6H_5CHS)_3$.

SOLUBILITY OF EACH (DETERMINED SEPARATELY) IN SEVERAL SOLVENTS AT 25°.

(Suyver, 1905.)

Solvent.	Gms. per 100 Gms. Solvent.			
	α $(CH_3CHS)_3$.	β $(CH_3CHS)_3$.	α $(C_6H_5CHS)_3$.	β $(C_6H_5CHS)_3$.
Ether	15.58	13.67	1.09	0.37
Ethyl Alcohol	3.86	3.97	0.20	0.04
Methyl Alcohol	4.04	3.89	0.17	0.04
Acetone	20.96	18.31	2.45	1.12
Chloroform	57.59	51.22	11.11	0.20
Carbon Disulfide	25.50	20.75	5.81	0.22
Benzene	36.40	26.98	6.08	0.014
Ethyl acetate	17.52	15.48	2.05	0.93

Data for the solidification points of mixtures of α and β trithioacetaldehyde are also given. Similar data for mixtures of α and β trithiobenzaldehyde could not be determined on account of decomposition with production of resins.

TROPIC ACID (α Phenylhydracrylic Acid) *i* and *l*, $C_6H_5.CH(CH_2OH)COOH$.

100 gms. sat. solution in H_2O contain 1.975 gms. of the *i* acid at 20°.
100 gms. sat. solution in H_2O contain 2.408 gms. of the *l* acid at 20°. (Schlossberg. 1900.)

TURPENTINE OIL

SOLUBILITY IN ETHYL ALCOHOL.

(Vezes and Mouline, 1904, 1905-06.)

Spirit of turpentine and absolute alcohol are miscible in all proportions and the mixture may be cooled to a very low temperature without ceasing to be homogeneous. In the case of alcohol containing a small amount of water, the mixture, which is uniform at ordinary temperature, separates into two layers when cooled. The following data were obtained for mixtures of 98 vol. % alcohol (= 0.968 gm. C_2H_5OH per 1 gm. aq. alcohol) and spirits of turpentine and for mixtures of 95 vol. % alcohol (= 0.924 gm. C_2H_5OH per 1 gm. aq. alcohol) and spirits of turpentine.

Results for 98 Vol. % Alcohol.				Results for 95 Vol. % Alcohol.			
t° of Separation.	Gms 98 Vol. % Alcohol per 100 Gms. Mixture.	t° of Separation.	Gms 98 Vol. % Alcohol per 100 Gms. Mixture.	t° of Separation.	Gms. 95 Vol. % Alcohol per 100 Gms. Mixture.	t° of Separation.	Gms. 95 Vol. % Alcohol per 100 Gms. Mixture.
−35.6	2.7	−20.9	32.9	+20.7	2.4	29.6	48.3
−23	4.8	−26.1	42.6	42.2	3.4	23.9	52.8
−20.9	9.5	−30	48.2	53	7.2	16.3	61.4
−18.1	13.2	−45.3	58	53.1	10.2	−15.5	76.6
−17.8	16	−79.2	71.9	44	20.3	−24	81.1
−18.8	24.4			37.2	30.6	−63	87.1

Data in regard to the sample of spirits of turpentine which was used, are not given.

URANYL Potassium BUTYRATE $UO_2(C_4H_7O_2)_2.KC_4H_7O_2$.

The double salt is decomposed by water at ordinary temperatures and the solution gets richer in uranyl butyrate. The solubility at 29.4° in water containing $KC_4H_7O_2$ is 2.10 gms. $UO_2(C_4H_7O_2)$ + 0.38 gm. $KC_4H_7O_2$ per 100 gms. solution. The atomic relation being 1 : 0.64. (Rimbach, 1904.)

URANYL Ammonium CARBONATE $UO_2CO_3.2(NH_4)_2CO_3$.

SOLUBILITY IN WATER.

(Giolitti and Vecchiarelli, 1905.)

A large excess of the double carbonate was agitated with water at constant temperature and the clear saturated solutions analyzed.

t°.	Gms per 100 Gms. Sat. Sol.			Mol Ratio.		
	U.	CO_2.	NH_3.	U	: CO_2	: NH_3.
18.6	2.71	1.54	0.795	1	3.08	4.10
36.5	3.09	2.29	1.188	1	4.01	5.35
48.3	3.03	2.71	1.35	1	4.95	6.35
62	...	3.17	1.62	...	...	...
87.3	3.95	3.96	2.027	1	5.42	7.15

Theoretical molecular ratio for $UO_2CO_3.2(NH_4)_2CO_3$ = 1 : 3 : 4.

Thus at the lower temperature, the composition of the dissolved salt is very near the ratio corresponding to the formula.

The author calculates that 6.04 gms. of $UO_2CO_3.2(NH_4)_2CO_3$ are contained in 100 gms. of the sat. solution at 18.6° (a recalculation from the U value, 2.71, indicates that this figure should be 5.26 gms.).

URANYL CHLORIDE $UO_2Cl_2.3H_2O$.

100 gms. H_2O dissolve 320 gms. UO_2Cl_2 at 18°. (Mylius and Dietz, 1901.)

SOLUBILITY OF URANYL AMMONIUM CHLORIDE, U. TETRA METHYL AMMONIUM CHLORIDE, U. TETRA ETHYL AMMONIUM CHLORIDE, U. CAESIUM CHLORIDE, U. RUBIDIUM CHLORIDE, AND U. POTASSIUM CHLORIDE IN WATER.

(Rimbach, 1904.)

Formula of Double Salt.	t°.	Gms. per 100 Gms. Sat. Sol.	Atomic Relation in Sol.	Solid Phase.
$UO_2Cl_2.2NH_4Cl.2H_2O$	15	$40.67UO_2+3.51NH_4+19.15Cl$	$1UO_2:1.59NH_4:3.59Cl$	1 Mol. double salt +0.4 Mol. NH_4Cl
$UO_2Cl_2.2N(CH_3)_4Cl$	29.8	19.85 " $+10.44Cl_2$ =41.24*	$1UO_2:4.02Cl$	Double salt
	80.7	20.23 " $+10.52Cl_2$ =41.91*	$1UO_2:3.98Cl$	"
$UO_2Cl_2.2N(C_2H_5)_4Cl$	27.1	15.02 " $+7.81Cl_2$ =37.15†	$1UO_2:3.97Cl$	"
"	80.7	15.12 " $+7.78Cl_2$ =37.23†	$1UO_2:3.94Cl$	"
$UO_2Cl_2.2CsCl$	29.75	22.11 " $+22.5$ Cs =56.04‡	$1UO_2:2.07Cs$	"
$UO_2Cl_2.2RbCl.2H_2O$	24.8	27.18 " $+16.6$ Rb $+13.8Cl$§	$1UO_2:1.96Rb:3.90Cl$	"
"	80.3	30.66 " $+19.1$Rb $+15.8Cl$‖	$1UO_2:1.98Rb:3.95Cl$	"
$UO_2Cl_2.2KCl.2H_2O$	0.8	38.57 " $+13.59Cl$ + 3.86K	$1UO_2:2.69Cl:0.69K$	The double salt is decomposed by water at temperatures below 60°.
"	14.9	33.71 " $+13.51Cl$ + ... K	$1UO_2:3.06Cl:1.06K$	
"	17.5	37.36 " $+14.50Cl$ + 5.27K	$1UO_2:2.96Cl:0.96K$	
"	25	35.01 " $+15.26Cl$ + .. K	$1UO_2:3.33Cl:1.33K$	
"	41.5	35.27 " $+15.92Cl$ + 7.39K	$1UO_2:3.44Cl:1.44K$	
"	50	34.18 " $+16.56Cl$ + ... K	$1UO_2:3.71Cl:1.71K$	
"	60	34.19 " $+17.25Cl$ + 9.14K	$1UO_2:3.85Cl:1.85K$	
"	71.5	33.55 " $+17.44Cl$ + 9.28K	$1UO_2:3.96Cl:1.96K$	Double salt
"	78.5	35.26 " $+18.24Cl$ + 9.95K	$1UO_2:3.95Cl:1.95K$	"

* $UO_2Cl_2.2N(CH_3)_4Cl$. † $UO_2Cl_2.N(C_2H_5)_4Cl$. ‡ $UO_2Cl_2.2CsCl$.
§ =57.9 gms. $UO_2Cl_2.2RbCl_2$. ‖ =65.8 gms. $UO_2Cl_2.2RbCl_2$.

URANYL Sodium **CHROMATE** $2(UO_2)CrO_4.Na_2CrO_4.10H_2O$.

100 gms. sat. aqueous solution contain 52.52 gms. $2(UO_2)CrO_4Na_2CrO_4$ at 20°. (Rimbach, 1904.)

URANYL IODATE $UO_2(IO_3)_2$.

SOLUBILITY OF THE DIFFERENT CRYSTALLINE FORMS IN WATER AT 18°.

(Artmann, 1912–13.)

	Appearance of Crystals.	Gms. $UO_2(IO_3)_2$ per 100 Gms. H_2O.
$UO_2(IO_3)_2.H_2O$	Type I warty, later prismatic needles	0.1049
"	Type II pyramids, sphenoids	0.1214
$UO_2(IO_3)_2.2H_2O$		0.2044

URANYL NITRATE $UO_2(NO_3)_2.6H_2O$.

SOLUBILITY IN WATER.

(Wasilieff, 1910.)

t°.	Gms. $UO_2(NO_3)_2$ per 100 Gms. Sat. Sol.	Solid Phase.	t°.	Gms. $UO_2(NO_3)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
−1.6	10.83	Ice	−2.2	48.77	$UO_2(NO_3)_2.6H_2O$
−2.1	12.24	"	0	49.46	"
−2.9	17.19	"	5.5	50.55	"
−4.4	23.52	"	12.3	52.88	"
−6	26.20	"	21.1	55.98	"
−7.9	32.53	"	25.6	57.17	"
−11.2	37.09	"	36.7	61.27	"
−18.1	43.12	" $+UO_2(NO_3)_2.6H_2O$	45.2	65.12	"
−12.1	45.53	$UO_2(NO_3)_2.6H_2O$	51.8	67.76	"

100 gms. abs. acetone dissolve 1.5 gms. $UO_2(NO_3)_2.6H_2O$ at 12°. (de Coninck, 1900.)
100 gms. 85% alcohol dissolve 3.3 gms. $UO_2(NO_3)_2.6H_2O$ at 12°. "
Data for the densities of uranyl nitrate solutions in water and other solvents are given by de Coninck (1900).

SOLUBILITY OF URANYL NITRATE IN ETHER.
(Lebeau, 1911.)

When a large excess of uranyl nitrate is shaken with ether at 7°, two liquid layers are formed. The ethereal layer contains 59 gms. $UO_2(NO_3)_2$ per 100 gms. of solution and the aqueous layer contains 62.5 gms. per 100 gms. of solution. An elevation of temperature was noted when ether and $UO_2(NO_3)_2.6H_2O$ were mixed at room temperature, therefore, indicating that solution is accompanied by combination and elimination of the water of the salt.

URANYL DOUBLE NITRATES.

SOLUBILITY OF URANYL AMMONIUM NITRATE + URANYL NITRATE; U. CAESIUM NITRATE + CAESIUM NITRATE; U. POTASSIUM NITRATE + POTASSIUM NITRATE AND U. RUBIDIUM NITRATE + RUBIDIUM NITRATE IN WATER.
(Rimbach, 1904.)

Formula of Salt.	t°.	Gms. per 100 Gms Sat Solution. UO_2.	Total Salt.	Atomic Relation in Solution.
$UO_2(NO_3)_2.NH_4NO_3$	0.5	29.71 + 2 92 NH_4	= ...	1 UO_2: 1.47 NH_4: 3.47 NO_3
"	24 9	36.46 + 3.54 "	= 68.95	" : 1 46 " : 3.46 "
"	59	44.37 + 2.90 "	= ...	" : 0 98 " : 2.98 "
"	80.7	44.95 + 2 98 "	= 78.95	" : 1 " : 3 "
$UO_2(NO_3)_2.CsNO_3$	16	31.39 + 6.59 Cs	= 55 4	" : 0.44 Cs
$UO_2(NO_3)_2.KNO_3$	0 5	31.98 + 1.72 K	= ...	" : 2.37 NO_3 : 0.37 K
"	13	33.40 + 2.72 "	= ...	" : 2.57 " : 0.57 "
"	25	37 07 + 4 01 " *	= 64.82	" : 1.60 " : 0.76 "
"	45	42 18 + 5 16 "	= ...	" : 2.84 " : 0.84 "
"	59	41.65 + 6 03 "	= ...	" : 3 " : 1 "
"	80.6	43 71 + 6 38 "	= 80 1	" : 3 01 " : 1.01 "
$UO_2.(NO_3)_2.RbNO_3$	25	35 41 + 4 65 Rb†	= 59.60	" : 1.40 " : 0.45 Rb
"	80	34.66 + 11.01 "	= 69.49	" : 3 " : 1.01 "

* + 23.5NO_3. † + 19 74NO_3.

URANYL OXALATE $UO_2.C_2O_4.3H_2O$.

100 gms. H_2O dissolve 0.7401 gm. $UO_2C_2O_4.3H_2O$ at 25°. (Dittrich, 1899.)

EQUILIBRIUM IN THE SYSTEM URANYL OXALATE, AMMONIUM OXALATE AND WATER.
(Colani, 1917)

Results at 15°. Gms. per 100 Gms. Sat. Solution. $UO_2C_2O_4$.	$(NH_4)_2C_2O_4$.	Solid Phase.	Results at 50°. Gms. per 100 Gms. Sat Solution. $UO_2C_2O_4$.	$(NH_4)_2C_2O_4$.	Solid Phase.
0.47	0	$UO_2C_2O_4.3H_2O$	1	0	$UO_2.C_2O_4.3H_2O$
7.19	2.14	" $+(NH_4)_2(UO_2)_2(C_2O_4)_3.3H_2O$	5.11	1.36	" $+(NH_4)_2(UO_2)_2(C_2O_4)_3$
8.78	2 99	$(NH_4)_2(UO_2)(C_2O_4)_2.2H_2O+$ "	19 89	8.52	$(NH_4)_2(UO_2)(C_2O_4)_2+$ "
9.66	6.43	" $+(NH_4)_2C_2O_4.H_2O$	23.82	15 90	" $+(NH_4)_2C_2O_4.H_2O$
0	3.69	$(NH_4)_2C_2O_4.H_2O$	0	9.36	$(NH_4)_2C_2O_4.H_2O$

Two determinations at 75° are also given.

EQUILIBRIUM IN THE SYSTEM URANYL OXALATE, POTASSIUM OXALATE AND WATER.
(Colani, 1916a)

Results at 15°. Gms. per 100 Gms. Sat. Solution. $UO_2C_2O_4$.	$K_2C_2O_4$.	Solid Phase.	Results at 50°. Gms. per 100 Gms. Sat Solution. $UO_2P_2O_4$.	$K_2C_2O_4$.	Solid Phase.
0.47	0	$UO_2C_2O_4.3H_2O$	1	0	$UO_2C_2O_4.3H_2O$
1.34	0.42	" $+K_2(UO_2)_2(C_2O_4)_3.4H_2O$	3.45	1.11	" $+K_2(UO_2)_2(C_2O_4)_3.4H_2O$
3.89	1.83	$K_2(UO_2)(C_2O_4)_2.3\frac{1}{2}H_2O+$ "	9.82	4.83	$K_2(UO_2)(C_2O_4)_2+$ "
3.76	1.85	" $+K_6(UO_2)_2(C_2O_4)_5.10H_2O$	9.59	5.61	" $+K_6(UO_2)_2(C_2O_4)_5.10H_2O$
0.10	24.30	$K_2C_2O_4.H_2O+$ "	1.22	32.65	$K_2C_2O_4.H_2O+$ "
0	24.09	$K_2C_2O_4.H_2O$	0	32.75	$K_2C_2O_4.H_2O$

SOLUBILITY OF URANYL OXALATE IN AQUEOUS SODIUM OXALATE AT 25°.
(Dittrich, 1899.)

Gms. $Na_2C_2O_4$ per 100 cc. Solution.	Gms. $UO_2.C_2O_4.3H_2O$ per 100 cc. Sat. Solution.
0.6706	2.0125
0.3353	0.9867
0.2235	0.6059

URANYL Ammonium **PROPIONATE** $2UO_2(C_3H_5O_2)_2.NH_4C_3H_5O_2.2H_2O$.

URANYL Potassium **PROPIONATE** $UO_2(C_3H_5O_2)_2.KC_3H_5O_2$.

100 gms. aq. solution contain 16.48 gms. $2UO_2(C_3H_5O_2)_2.NH_4C_3H_5O_2$ at 29.8°.
100 gms. aq. solution contain 2.362 gms. $UO_2(C_3H_5O_2)_2$ + 0.82 gm. $KC_3H_5O_2$ at 29.4°, atomic relation, 1: 1.29. (Rimbach, 1904.)

URANYL SULFATE $UO_2SO_4.3H_2O$.

SOLUBILITY IN SEVERAL SOLVENTS.
(de Coninck, 1901, 1903)

Solvent	t°.	Gms UO_2SO_4-$3H_2O$ per 100 Gms Solvent.	Solvent.	t°.	Gms. UO_2SO_4-$3H_2O$ per 100 Gms. Solvent.
Water	13.2	18.9	Conc. HBr (d=1.21)	12	16.8
Water	15.5	20.5	Conc. HNO_3	12	9.1
16.2% Alcohol	10	12 3	Conc. H_2SO_4 (d=1.138)	13	24.3
85% Alcohol	16	2.6	1 Vol. HCl+1 Vol. HNO_3	16	18
Conc. HCl	13	30	Selenic Acid (d=1.4)	15	27

URANYL Potassium **SULFATE** $UO_2SO_4.K_2SO_4.2H_2O$.

100 gms. sat. aq. solution contain 10.41 gms. $UO_2SO_4.K_2SO_4$ at 25° and 23.13 gms. at 70.5°. (Rimbach, 1904.)

SOLUBILITY OF $UO_2SO_4.2K_2SO_4.2H_2O$ + $UO_2SO_4.K_2SO.2H_2O$ IN WATER.

t°.	Gms. per 100 Gms Solution.			Atomic Relation in Sol			Mol. % in Solid Phase.	
	UO_2.	K.	SO_4	UO_2	K	SO_4.	Mono Salt.	Di Salt
14	0.85	4.19	5 71	1 :	35.75 :	18.88	29	71
50	6.70	8.15	12.37	1 :	5 20 :	8.40	76	24
80	14.29	8.54	15.53	1 :	4.13 :	3.06	12	88

URANIUM SULFATE (ous) $U(SO_4)_2$.

SOLUBILITY IN WATER.
(Giolitti and Bucci, 1905)

t°.	Gms. $U(SO_4)_2$ per 100 Gms. Sat. Sol.	Solid Phase	t°.	Gms. $U(SO_4)_2$ per 100 Gms. Sat. Sol.	Solid Phase.
18	10.17	$U(SO_4)_2.8H_2O$	93	63.2	$U(SO_4)_2.8H_2O$
25.6	13.32	"	24	9.8	$U(SO_4)_2.4H_2O$
37	19.98	"	37	8 3	"
48.2	28.72	"	48.2	8.1 (7.8)	"
62	36.8	"	63	7.3	"

The determinations were made with difficulty on account of the considerable tendency towards formation of basic sulfate and simultaneous clouding of the solution.

APPROXIMATE SOLUBILITY OF URANIUM SULFATE, IN AQUEOUS SOLUTIONS.
(de Coninck, 1903.)

Solvent.	t°.	Gms. $U(SO_4)_2.4H_2O$ per 100 Gms. Solvent.	Solvent.	t°.	Gms. $U(SO_4)_2.4H_2O$ per 100 Gms. Solvent.
Water	11	23.2	Dilute Selenic Acid (1:4)	11.4	21.7
Dilute HCl (1:4)	9	17.2	Dilute H_2SO_4 (1:4)	10	15.6
Dilute HNO_3 (1:4)	10.5	18.2	Dilute Alcohol (1:4)	11.3	12.3

UREA $CO(NH_2)_2$.

Solubility in Water and in Alcohols.

(Campetti, 1902; Speyers, 1902.)

Note. — Speyer's original results are in terms of Mols. $CO(NH_2)_2$ per 100 mols. H_2O at irregular temperatures.

t°.	In Water. Wt. of 1 cc. Solution.	Gms. $CO(NH_2)_2$ per 100 Gms. H_2O.		In Methyl Alcohol. Wt. of 1 cc. Solution.	Gms. $CO(NH_2)_2$ per 100 Gms. CH_3OH.	In Ethyl Alcohol. Wt. of 1 cc. Solution.	Gms. $CO(NH_2)_2$ per 100 Gms. C_2H_5OH.
0	1.121	55.9	...	0.861	13.8	0.8213	2.5
10	1.134	66.0	85.0 (C)	0.863	16.0	0.814	3.5
20	1.146	79.0	108.2 (C)	0.869	20.0	0.809	5.0
30	1.156	93.0	...	0.876	24.0	0.806	6.5
40	1.165	106.0	...	0.890	30.0	0.804	8.5
50	1.173	120.0	...	0.908	37.0	0.803	10.5
60	1.180	132.0	...	0.928	47.0	...	13.0
70	1.187	145.0	...	...	...	...	17.5

100 gms. abs. methyl alcohol dissolve 21.8 gms. $CO(NH_2)_2$ at 19.5°.
100 gms. abs. ethyl alcohol dissolve 5.06 gms. $CO(NH_2)_2$ at 19.5°. (de Bruyn, 1903.)

Solubility of Urea in Alcohols.

(Timofeiew, 1894)

Alcohol.	t°.	Gms. $CO(NH_2)_2$ per 100 Gms. Solvent.	Alcohol.	t°.	Gms. $CO(NH_2)_2$ per 100 Gms. Solvent.
Methyl Alcohol	−12	11	Isopropyl Alcohol	19.4	5.76
"	0	14.2	"	20	6.17
"	19	20.9	"	81	23.46
"	40	36.4	Isobutyl Alcohol	0	1.01
"	62	66.6	"	19	1.65
"	71	107 4	"	41	3.12
Ethyl Alcohol	− 9	2.69	"	60	4.40
"	0	3.26	"	80	6.34
"	18	5	"	98	10
"	41	9.45	Isoamyl Alcohol	20	1.18
"	60	16.3	"	60	3.41
"	81	30.8	"	80	4.88
Propyl Alcohol	0	1.65	"	83	5.24
"	20	2.56	"	98	6.15
"	40	5.12	Capryl Alcohol	19.4	0.56
"	60	7.72	"	98	2
"	80	12.28	Ally Alcohol	19.4	9.37
"	98	18.06			

Solubility of Urea in Ethyl Acetate containing Small Amounts of Water at 25°.

(Lewis and Burrows, 1912.)

Gms. H_2O per 100 Gms. Solvent. (Ethyl Acetate+H_2O).	Gms. Urea per 100 Gms. Sat. Sol.	Gms. H_2O per 100 Gms. Solvent. (Ethyl Acetate+H_2O).	Gms. Urea per 100 Gms. Sat. Sol.
0	0.080	1.677	0.308
0.652	0.148	2.006	0.328*
1.112	0.198	2.138	0.342
1.638	0.296	3.234	0.343†

* A second liquid phase was suspected here. † A second liquid phase could be distinguished.

Solubility of Urea in Ethyl Ether.

(Gortner, 1914.)

When 0.3255 gm. urea was extracted in a Soxhlet apparatus with anhydrous ether for 48 hours, the extract was found to contain 0.072 gm. urea. An approximate estimate, based on the volume of liquid and the number of siphonings per hour indicates a solubility of 0.0004 gm. urea per 100 cc. of ether.

100 gms. glycerol dissolve about 50 gms. urea at 15°.
100 gms. pyridine dissolve 0.96 gm. urea at 20–25°. (Dehn, 1917.)
100 gms. aq. 50% pyridine dissolve 21.53 gms. urea at 20–25°.

Diphenyl UREA.

100 gms. H_2O dissolve 0.015 gm. diphenyl urea (sym or uns.?) at 20–25°.
" pyridine dissolve 6.85 gms. diphenyl urea (sym or uns.?) at 20–25°.
" aq. 50% pyridine dissolve 5.3 gms. diphenyl urea (sym or uns.?) at 20–25°. (Dehn, 1917.)

ThioUREA $NH_2.CS.NH_2$.

100 gms. H_2O dissolve 9.1 gms. thiourea at 20–25°.
" pyridine dissolve 12.5 gms. thiourea at 20–25°.
" aq. 50% pyridine dissolve 41.2 gms. thiourea at 20–25°. (Dehn, 1917.)

Allyl ThioUREA (Thiosinamine) $NH_2.CS.NH.C_3H_5$.

100 cc. H_2O dissolve about 5.9 gms. $NH_2.CS.NH.C_3H_5$ at 15–20°.
100 cc. 90% alcohol dissolve about 50 gms. $NH_2.CS.NH.C_3H_5$ at 15–20°. (Squire and Caines, 1905.)

Phenyl ThioUREA (Phenyl thiocarbamide) $CS.NH_2.NHC_6H_5$.

Solubility in Water.

(Rothmund, 1900; Biltz, 1903; Hollman and Antusch, 1894; Bogdan, 1902–03.)

One liter aq. solution contains 2.12 gms. $CS(NH_2).NHC_6H_5$ at 20° (B.), (R.) and 2.4 gms at 25°. (H. and A.). Bogdan gives 2.547 gms. at 25°.

Solubility of Phenyl Thiourea at 25° in Aqueous Solutions of.

Potassium Nitrate. (Bogdan, 1902–03.)

Gms. Mols. KNO_3 per 1000 Gms. H_2O.	Gms. per 1000 Gms. H_2O. KNO_3.	Gms. per 1000 Gms. H_2O. $CS(NH_2).NHC_6H_5$.
1.045	105.7	2.38
0.5123	51.84	2.48
0.2026	20.50	2.54
0.1007	10.19	2.56
0.0503	5.09	2.55
0.0333	3.36	2.55

Sodium Nitrate. (Bogdan, 1902–03.)

Gms. Mols. $NaNO_3$ per 1000 Gms. H_2O.	Gms. per 1000 Gms. H_2O. $NaNO_3$.	Gms. per 1000 Gms. H_2O. $CS(NH_2)NHC_6H_5$.
1.024	87.14	2.26
0.5065	43.10	2.46
0.2031	17.28	2.51
0.0986	8.39	2.53
0.0540	4.59	2.54
0.0335	2.84	2.54

Solubility of Phenyl Thiourea in Aqueous Salt Solutions at 20°.

(Biltz, 1903; Rothmund, 1900.)

Salt Solution.	Millimols and the Equivalent Gms. $CS(NH_2)NHC_6H_5$ Dissolved per Liter of Aqueous Salt Solution of Concentration: 0.125 Normal Millimols.	Gms.	0.25 Normal Millimols.	Gms.	0.5 Normal. Millimols.	Gms.	1 Normal Millimols.	Gms.
$\frac{1}{3}AlCl_3$	12.95	1.97	12.82	1.96	12.03	1.83	10.69	1.61
NH_4NO_3	14.17	2.15	14.4	2.21	14.53	2.22	14.91	2.27
$\frac{1}{2}(NH_4)_2SO_4$	13.51	2.05	12.84	1.96	11.78	1.79	9.98	1.52
$\frac{1}{2}BaCl_2$	13.12	1.99	12.92	1.97	12.22	1.86	10.44	1.59
$\frac{1}{2}Ba(NO_3)_2$	13.98	2.13	13.98	2.13	13.90	2.12	...	...
$CsNO_3$	14.53	2.21	14.90	2.27	15.23	2.33	...	...
$LiNO_3$	13.96	2.13	13.96	2.13	13.93	2.12	13.73	2.10
$\frac{1}{2}MgSO_4$	13.40	2.04	12.78	1.95	11.54	1.75	9.43	1.43
$KC_2H_3O_2$	13.40	2.04	12.95	1.97	12.14	1.85	10.74	1.62
KBr	13.50	2.05	13.35	2.04	12.80	1.95	11.76	1.79
$KClO_3$	13.86	2.11	13.60	2.06	13.12	1.99	...	...
KCl	13.40	2.04	12.73	1.94	12.19	1.85	10.54	1.60
KI	14.12	2.15	14.48	2.21	14.31	2.18	14.60	2.23
KNO_3	13.89	2.12	13.85	2.11	13.52	2.05	12.82	1.96
KNO_2	14.52	2.21	14.65	2.23	13.80	2.11	12.51	1.92
$\frac{1}{2}K_2SO_4$	13.25	2.03	12.49	1.91	11.11	1.69	8.73	1.33
$RbNO_3$	14.22	2.16	14.44	2.19	14.39	2.18	14.22	2.17
$\frac{1}{2}Na_2CO_3$	13.29	2.04	12.52	1.91	11.05	1.68	8.58	1.32
$NaClO_3$	13.75	2.09	13.65	2.08	13.07	1.98	12.21	1.86
$NaClO_4$	14.15	2.15	14.05	2.14	13.58	2.06	12.56	1.92
NaCl	13.28	2.02	12.83	1.95	11.90	1.81	10.02	1.52
NaI	13.98	2.13	14.07	2.14	14.29	2.18	13.96	2.13
$NaNO_3$	13.94	2.12	13.77	2.10	13.32	2.04	12.57	1.92
$NaNO_2$	14.34	2.18	13.82	2.11	13.06	1.98	11.52	1.75
$\frac{1}{2}Na_2SO_4$	13.19	2.00	12.35	1.87	10.85	1.63	8.30	1.27

Solubility of Phenyl Thiourea in Ethyl Alcohol Solutions of Several Salts at 28°.

(Thorin, 1915.)

Salt.	Normality of Salt in C_2H_5OH.	Mols. $NH_2.CS.NHC_6H_5$ per 100 Gms. Sat. Sol.	Salt.	Normality of Salt in C_2H_5OH.	Mols. $NH_2.CS.NH.C_6H_5$ per 100 Gms. Sat. Sol.
None	(pure C_2H_5OH)	0.2065	NaI	0.043	0.2102
LiCl	0.168	0.2274	"	0.086	0.2148
"	0.337	0.2360	"	0.172	0.2198
"	0.673	0.2440	"	0.343	0.2271
"	1.346	0.2494	"	0.685	0.2359
$CaCl_2$	0.061	0.2101	NaBr	0.022	0.2098
"	0.122	0.2135	"	0.043	0.2194
"	0.244	0.2194	"	0.086	0.2165
"	0.487	0.2279	"	0.172	0.2257
"	0.975	0.2372			

SOLUBILITY OF PHENYL THIOUREA IN MIXTURES OF ETHYL ALCOHOL AND WATER AT 25°.

(Holleman and Antusch, 1894.)

Vol. per cent Alcohol.	Gms. $CS(NH_2)NHC_6H_5$ per 100 Gms. Solvent.	Sp. Gr. of Solutions.	Vol. per cent Alcohol.	Gms. $CS(NH_2)NHC_6H_5$ per 100 Gms. Solvent.	Sp. Gr. of Solutions.
100	3.59	...	65	3.40	0.9018
95	4.44	0.8200	60	2.80	0.9128
90	4.69	0.8389	50	1.87	0.9317
85	4.99	0.8544	40	1.13	0.9486
80	4.70	0.8679	25	0.56	0.9679
75	4.45	0.8810	15	0.38	0.9788
70	3.92	0.8915	0	0.24	0.9979

See remarks under α acetnaphthalide, p. 13.

SOLUBILITY OF PHENYL THIOUREA IN AQUEOUS SOLUTIONS OF PROPYL AND OF ETHYL ALCOHOL AT 25°.

(Bogdan, 1902–03.)

In Aq. Propyl Alcohol.			In Aq. Ethyl Alcohol.		
G. Mols. C_3H_7OH per 1000 Gms. H_2O.	Gms. per 1000 Gms. H_2O C_3H_7OH.	Gms. per 1000 Gms. H_2O $CS(NH_2)NHC_6H_5$.	G. Mols. C_2H_5OH per 1000 Gms. H_2O.	Gms. per 1000 Gms. H_2O C_2H_5OH.	Gms. per 1000 Gms. H_2O $CS(NH_2)NHC_6H_5$.
1.035	62.10	3.587	1.1010	49.60	3.193
0.5448	32.688	3.124	0.5355	24.12	2.931
0.1059	6.354	2.643	0.1094	4.932	2.629
0.05526	3.316	2.599	0.05018	2.26	2.589
0.04854	2.912	2.586	0.03271	1.473	2.577
In Propyl Alcohol at 0°.					
1.000	60.06	1.21			
0.100	6.01	1.047			

SOLUBILITY OF PHENYL THIOUREA IN AQUEOUS SOLUTIONS OF ACETONE, MANNITOL, CANE SUGAR, DEXTROSE, AND UREA.

(Bogdan, 1902–03.)

Aqueous Non Electrolyte.	t°.	Gms. per 1000 Gms. H_2O Non Electrolyte.	Gms. per 1000 Gms. H_2O $CS(NH_2)NH.C_6H_5$.	Aqueous Non Electrolyte.	t°.	Gms. per 1000 Gms. H_2O. Non Electrolyte.	Gms. per 1000 Gms. H_2O. $CS(NH_2)NHC_6H_5$.
$(CH_3)_2CO$	25	7.478	2.667	$C_6H_{12}O_6$	25	180 40	3.042
"	"	2.513	2.579	"	"	90.46	2.83
"	"	1.908	2.573	"	"	29.29	2.69
$C_6H_8(OH)_6$	"	182.11	3.04	"	"	18.01	2.654
"	"	91.05	2.78	"	"	9.554	2.603
$C_{12}H_{22}O_{11}$	25	338.6	3.457	$CO(NH_2)_2$	"	63.08	3.306
"	"	170.4	3.015	"	"	29.93	2.892
"	"	34.36	2.634	"	"	6.132	2.618
"	"	18.28	2.596	"	"	4.942	2.605
"	"	10.09	2.572	"	"	2.009	2.572
"	0	342.18	1.420	"	0	60.11	1.310
"	"	34.22	1.044	"	"	6.01	1.048

UREIDE OF GLUCOSE $CH_2OH.(CHOH)_4.CH : N.CO.NH_2$.

100 gms. absolute ethyl alcohol dissolve 0.04 gm. ureide of glucose at 25°.
" 85.6% " " 0.73 " " "
" methyl alcohol " 0.22 " " "

(Schoorl, 1903.)

URETHAN (Ethyl Carbamate) $NH_2.CO_2.C_2H_5$. (See also p. 296.)

SOLUBILITY OF URETHAN IN SEVERAL SOLVENTS.

(Speyers, 1902.)

Interpolated and calculated from the original results which are given in terms of molecules urethan per 100 mols. solvent.

t°.	Solubility in Water. Wt. of 1 cc. Solution.	Mols. $CO(NH_2)OC_2H_5$ per 100 Mols. H_2O.	Gms. $CO(NH_2)OC_2H_5$ per 100 Gms. H_2O.	Solubility in Methyl Alcohol. Wt. of 1 cc. Solution.	Mols. $CO(NH_2)OC_2H_5$ per 100 Mols. CH_3OH.	Gms. $CO(NH_2)OC_2H_5$ per 100 Gms. CH_3OH.
0	1.023	3.61	17.8	0.956	31.18	86.76
10	1.033	6.0	29.7	0.977	41.0	114.1
15	1.042	15.0	74.2	0.989	47.5	132.1
20	1.060	31.0	153.3	1.000	54.5	151.7
25	1.073	50.0	247.3	1.013	62.5	173.9
30	1.078	65.0	321.4	1.024	72.0	200.3
40	1.065	77.0	380.7	1.045	89.0	247.7

t°.	Solubility in Ethyl Alcohol. Wt. of 1 cc. Solution.	Mols. $CO(NH_2)OC_2H_5$ per 100 Mols. C_2H_5OH.	Gms. $CO(NH_2)OC_2H_5$ per 100 Gms. C_2H_5OH.	Solubility in Propyl Alcohol. Wt. of 1 cc. Solution.	Mols. $CO(NH_2)OC_2H_5$ per 100 Mols. C_3H_7OH.	Gms. $CO(NH_2)OC_2H_5$ per 100 Gms. C_3H_7OH.
0	0.8914	23.91	46.26	0.880	19.48	28.9
10	0.930	36.0	69.6	0.906	31.0	46.0
15	0.950	43.0	89.2	0.923	40.0	59.3
20	0.968	50.0	96.7	0.942	51.0	75.7
25	0.985	59.0	114.1	0.963	60.0	89.0
30	1.001	70.0	135.4	0.983	68.0	100.9
40	1.035	88.0	170.2	1.025	85.0	126.1

t°.	Solubility in Chloroform. Wt. of 1 cc. Solution.	Mols. $CO(NH_2)OC_2H_5$ per 100 Mols. $CHCl_3$.	Gms. $CO(NH_2)OC_2H_5$ per 100 Gms. $CHCl_3$.	Solubility in Toluene. Wt. of 1 cc. Solution.	Mols. $CO(NH_2)OC_2H_5$ per 100 Mols. $C_6H_5CH_3$.	Gms. $CO(NH_2)OC_2H$ per 100 Gms. $C_6H_5CH_3$.
0	1.404	27.56	20.6	0.887	1.77	1.71
10	1.340	41	30.6	0.874	5.0	4.84
15	1.310	46	34.4	0.875	10.0	9.68
20	1.280	53	39.6	0.883	16.0	15.48
25	1.240	60	44.8	0.902	25.0	24.18
30	1.203	67	50.0	0.927	44.0	42.58
40	1.125	80	59.7	0.995	85.0	82.24

100 gms. sat. solution in liquid CO_2 contain 4 gms. urethan at the critical temperature, 23.5°; at 30.5° the mixture separates with two layers. (Büchner, 1905–06.)

100 gms. pyridine dissolve 21.32 gms. urethan at 20–25°. (Dehn, 1917.)
100 gms. aq. 50% pyridine dissolve 101.1 gms. urethan at 20–25°. "

SOLUBILITY OF URETHAN DERIVATIVES IN WATER.

(Odaira, 1915.)

Name.	Formula.	t°.	Gms. Cmp per 100 Gms. H_2O.
Detonal (Diethyl Aceturethan)	$(C_2H_5)_2CH.CO.NH.CO.OC_2H_5$	...	0.526
Epronal (Ethylpropyl Aceturethan)	$(C_2H_5)(C_3H_7)CH.CO.NH.CO.OC_2H_5$	cold	0.143
Dipronal (Dipropyl Aceturethan)	$(C_3H_7)CH.CO.NH.CO.OC_2H_5$	20	0.040
Probnal (Propylbutyl Aceturethan)	$(C_3H_7)(C_4H_9)CH.CO.NH.CO.OC_2H_5$	20	0.032
Dibnal (Dibutyl Aceturethan)	$(C_4H_9)_2CH.CO.NH.CO.OC_2H_5$	...	0.008
Oenanthyl Urethan	$CH_3(CH_2)_5CO.NH.CO.OC_2H_5$	...	0.021
n Isoamyl Urethan	$(C_2H_5)_2CH.NH.CO.OC_2H_5$	20	0.410
α Bromethyl Propyl Aceturea	$(C_2H_5)(C_3H_7)CBr.CO.NH.CO.NH_2$	20	0.041

DISTRIBUTION OF URETHAN DERIVATIVES BETWEEN WATER AND OLIVE OI

Name.	Formula.	t°.	Gms. Cmpd. per 100 cc. H_2O Layer.	Gms. Cmpd. per 100 cc. Olive Oil Layer.	Dist. Rat $\frac{Conc._{oil}}{Conc._{H_2O}}$
Ethyl Urethan	$NH_2COOC_2H_5$	ord.	4.52	0.615	0.136 (
Methyl Urethan	NH_2COOCH_3	ord.	7.50	0.275	0.037 (
Aceturethan	$CH_3CONH.COOC_2H_5$	17–20	2.94	0.389	0.132 (
Epronal	$(C_2H_5)(C_3H_7)CH.CO.NH.CO.OC_2H_5$	"	0.076	0.257	3.3 (2)
Detonal	$(C_2H_5)_2CH.CO.NH.CO.OC_2H_5$	"	0.122	0.213	1.8 (2)
			0.326	0.549	1.7 (2)
Veronal (diethylbarbituric acid)	$CO(NHCO)_2C.(C_2H_5)_2$	"	0.180	0.020	0.11 (2)
			0.268	0.032	0.12 (2)

(1) Baum, 1899; H. von Meyer, 1909. (2) Odaira, 1915.

URIC ACID $C_5H_4N_4O_3$.

SOLUBILITY IN WATER.

(Blarez and Deniges, 1887; at 15° Magnier, 1875.)

t°.	Gms. $C_5H_4N_4O_3$ per 100 Gms. H_2O.	t°.	Gms. $C_5H_4N_4O_3$ per 100 Gms. H_2O.	t°.	Gms. $C_5H_4N_4O_3$ per 100 Gms. H_2O.
0	0.002	30	0.0088	70	0.0305
10	0.0037	40	0.0122	80	0.0390
15	0.0053	50	0.0170	90	0.0498
20	0.006	60	0.0230	100	0.0625

One liter of very carefully purified CO_2 free water dissolves 0.0253 gm. uri acid at 18°. Constant agitation and temperature were employed. With finel divided uric acid, saturation was reached after one hour. The amount dissolve was determined by the difference in weight between the amount of sample take and that remaining undissolved. (His, Jr. and Paul, 1900

One liter of pure CO_2 free water dissolves 0.0649 gm. uric acid at 37°. Th amount dissolved was determined by difference and only 20–25 minutes agitatio allowed for saturation. It is stated that on long contact with water, the uri acid breaks down and the solubility and conductivity increase directly with time (Gudzeit, 1909.

One liter of water dissolves 0.0645 gm. uric acid at 37°. (Bechhold and Ziegler, 1910.

One liter of serum dissolves 0.9 gm. uric acid at 37°. "

SOLUBILITY OF URIC ACID IN AQUEOUS SOLUTIONS OF ACID AT 18°.

(His, Jr. and Paul, 1900.)

Acid.	Concentration of Aq. Acid. Normality.	Per cent.	Gms. Uric Acid per 1000 cc. Sat Sol.
Hydrochloric	1	3.65	0.0236
"	3.75	13.69	0.0263
"	6.24	22.77	0.0375
Sulfuric	1	4.9	0.0227
	3.2	15.67	0.0205
	6.4	31.34	0.0183

Additional data for the solubility of uric acid in aqueous sulfuric acid are given by Tafel (1901). A saturated solution of crystallized uric acid in 80 wt. per cent aqueous H_2SO_4 was prepared by warming to about 120° and allowing to stand. Portions of the clear solution were diluted with increasing amounts of water and the mixtures allowed to stand many days in closed flasks which were frequently shaken. The precipitated uric acid was then filtered off and weighed and the amount remaining in solution calculated by difference. The following results were obtained.

Wt. % of aq. H_2SO_4	72.5	70.5	68	66.5	62.5	59.5
Gms. uric acid per 100 gms. aq. H_2SO_4	6.45	3.85	1.60	0.64	0.35	0.312

An approximate determination of the solubility of uric acid in alcohol by extraction in a Soxhlet apparatus, gave 0.00008 gms. per 100 cc. A similar determination with ether as solvent, gave negative results. (Gortner, 1914.)

100 gms. 95% formic acid dissolve 0.04 gm. uric acid at 20°. (Aschan, 1913.)

" pyridine dissolve 0.21 gm. uric acid at 20–25°. (Dehn, 1917.)

" aq. 50% pyridine dissolve 0.75 gms. uric acid at 20–25°. "

VALERIC ACID *n* $CH_3(CH_2)_3COOH$ (*n* Propyl Acetic Acid).

When valeric acid is shaken with water at 16°, two layers are formed.
100 gms. of the aqueous layer contain 3.4 gms. $CH_3(CH_2)_3COOH$.
100 gms. of the acid layer contain 90.4 gms. $CH_3(CH_2)_3COOH$.

(Lieben and Rossi, 1871.)

DISTRIBUTION OF VALERIC ACID BETWEEN BENZENE AND 95.8% SULFURIC ACID.

(Gurwitsch, 1914.)

The mixtures were made at 0° and brought to equilibrium by shaking for 5 minutes at 18°, and allowing to stand over night.

Gms. Valeric Acid per 100 Gms. Benzene Layer.	H_2SO_4 Layer.	Gms. Valeric Acid per 100 Gms. Benzene Layer.	H_2SO_4 Layer.
7.60	46.4	1	36.7
4.78	44.8	0.58	35.2
3.64	43.5	0.29	32.7
2.61	41.4	0.20	30.7
1.62	39.5	0.04	26.1
1.48	38.1	0.007	23.8

The coefficient of distribution of isovaleric acid between benzene and water at room temperature is, conc. in C_6H_6 ÷ conc. in H_2O = 2.744. (King and Narracott, 1909.)

DISTRIBUTION OF VALERAMIDES BETWEEN WATER AND OLIVE OIL AT 15°.
(Harrass, 1903.)

Amide.	Formula.	Gms. Cmpd. per per 100 cc. Water Layer.	Olive Oil Layer.	Ratio $\frac{Conc._{oil}}{Conc._{H_2O}}$.
Valeramide	$CH_3(CH_2)_3CONH_2$	0.769	0.241	0.313
Valerethylamide	$CH_3(CH_2)_3CONH(C_2H_5)$	1.029	0.261	0.254
Valerdiethylamide	$CH_3(CH_2)_3CON(C_2H_5)_2$	0.231	1.339	5.797
Valerdimethylamide	$CH_3(CH_2)_3CON(CH_3)_2$	0.911	0.379	0.416
Lactdiethylamide	$CH_3CHOHCON(C_2H_5)_2$	1.256	0.194	0.154

VANILLIN $C_6H_3.CHO.OCH_3.OH$, 1.3.4.

100 gms. H_2O dissolve 1 gm. vanillin at 20–25°. (Dehn, 1917.)
100 gms. pyridine dissolve 316 gms. vanillin at 20–25°. "

DISTRIBUTION OF VANILLIN BETWEEN WATER AND ETHER AT 25°.
(Marden, 1914.)

Gms Vanillin per 100 cc. H_2O Layer.	Ether Layer.	Dist. Coef.
0.0164	0.1294	0.108
0.0242	0.1854	0.110
0.0403	0.3310	0.104

Fusion-point data for mixtures of vanillin and orthovanillin are given by Noelting (1910). Qualitative solubilities of orthovanillin in a number of solvents are also reported. Data for the sintering, melting and clear liquid points for mixtures of vanillin and an extensive series of compounds are given by Lehmann (1914).

VERATRINE $C_{37}H_{53}NO_{11}$.

SOLUBILITY IN SEVERAL SOLVENTS.

Solvent.	t°.	Gms. Veratrine per 100 Gms. Solvent.	Authority.
Water	25	0.057	(U. S. P. VIII.)
Water	20	0.114	(Zalai, 1910.)
3% H_3BO_3 in Aq. 50% Glycerol	ord.	6	(Baroni & Barlinetto, 1911.)
Aniline	20	37	(Scholtz, 1912.)
Pyridine	20	175	"
Piperidine	20	83	"
Diethylamine	20	271	"
Oil of Sesame	20	1.39	(Zalai, 1910.)

VERATROLE $C_6H_4(OCH_3)_2$.

F.-pt. data for mixtures of veratrole and *p* xylene are given by Paterno and Ampola (1897).

VERONAL (Diethylbarbituric Acid) $CO<(NHCO)_2>C(C_2H_5)_2$. See also p. 742.

100 cc. H_2O dissolve 0.625 gm. veronal at 15–20°. (Squire & Caines, 1905.)
100 cc. 90% alcohol dissolve 11.7 gms. veronal at 15–20°. "
100 cc. ether dissolve 8.7 gms. veronal at 15–20°. "

VESUVIN.

100 gms. water dissolve 8.5 gms. vesuvin at 20–25°. (Dehn, 1917.)
" pyridine " 11.1 " " " "
" aq. 50% pyridine " 31.4 " " " "

WATER H_2O.

SOLUBILITY OF WATER IN BENZENE, PETROLEUM AND PARAFFINE OIL.
(Groschuff, 1911.)

The synthetic, sealed tube method was used and the experiments were made with very great care. The mixtures were first superheated sufficiently to bring all the water into solution and then cooled until a fine mist was formed. The temperature of appearance and disappearance of this fine mist was determined repeatedly. The benzene was of d_{20} = 0.8799. The petroleum was American water white, of d = 0.792. It was freed from H_2O by distilling 3 times from melted Na and boiled at 190–250° at atmospheric pressure. The paraffine oil was first heated to 120–130° and then distilled twice under vacuum over melted Na and once without Na. Its d_{18} = 0.883 and b.-pt. was 200°–300° at 10 mm. pressure.

Results for:

H_2O + Benzene.		H_2O + Petroleum.				H_2O + Paraffine Oil.	
t°.	Gms. H_2O per 100 Gms. Sol.	t°.	Gms H_2O per 100 Gms. Sol.	t°.	Gms. H_2O per 100 Gms. Sol.	t°.	Gms. H_2O per 100 Gms. Sol.
+3	0.030	−2	0.0012	59	0.031	+16	0.003
23	0.061	+18	0.005	61	0.035	50	0.013
40	0.114	23	0.007	66	0.043	65	0.022
55	0.184	30	0.008	79	0.063	73	0.030
66	0.255	36	0.012	85	0.075	77	0.035
77	0.337	53	0.026	94	0.097	94	0.055

Observations on the solubility of water in essential oils are given by Umney and Bunker (1912).

XENON Xe.

SOLUBILITY IN WATER.
(von Antropoff, 1909–10)

The results are in terms of the coef. of absorption β, as defined by Bunsen (see p. 227) and modified by Kuenen in respect to the substitution of mass for volume of water.

t°.	0°.	10°.	20°.	30°.	40°.	50°.
Abs. Coef. β	0.2180	0.1500	0.1109	0.0900	0.0812	0.0878

Nitro**XYLENES.**

100 gms. 95% formic acid dissolve 0.71 gm. trinitro-*m*-xylene (m. pt. 173°) at 18.5°. (Aschan, 1913.)

F.-pt. data for mixtures of 2.3, dinitro-*p*-xylene and 2.6, dinitro-*p*-xylene are given by Blanksma (1913).

XYLENOL 1.3.4, $C_6H_3.(CH_3)_2.OH$.

MISCIBILITY OF AQUEOUS ALKALINE SOLUTIONS OF XYLENOL WITH SEVERAL ORGANIC COMPOUNDS, INSOLUBLE IN WATER.
(Sheuble, 1907.)

To 5 cc. portions of aq. KOH solution (250 gms. per liter) were added the given amounts of the aq. insoluble compound from a buret and the xylenol, dropwise, until solution occurred. Temperature not stated.

Composition of Homogeneous Solution.

cc. Aq. KOH.	cc. Aq. Insol. Cmpd	Gms. Xylenol.
5	2 (=1.64 gms.) Octyl Alcohol (1)	1
5	5 (=4.10 ") "	1.7
5	2 (=1.74 ") Toluene	4.1
5	3 (=2.61 ") "	5

(1) The normal secondary octyl alcohol, *i.e.*, the so-called capryl alcohol, $CH_3(CH_2)_5.CH(OH)CH_3$.

YTTERBIUM Cobalti**CYANIDE** $Yb_2(CoC_6N_6)_2.9H_2O$.

1000 gms. aqueous 10% HCl (d_{15} = 1.05) dissolve 0.38 gm. of the salt at 25°. (James and Willand, 1916.)

YTTERBIUM OXALATE $Yb_2(C_2O_4)_3.10H_2O$.

SOLUBILITY IN WATER AND IN SEVERAL AQUEOUS SOLUTIONS.

Aqueous Solution of:	Per cent Conc. of Aq. Sol.	t°.	Gms. $Yb_2(C_2O_4)_3$ per 100 cc. Solvent.	Authority.
Water	...	25	0.000334	(Rimbach and Schubert, 1909.)
$(NH_4)_2C_2O_4.H_2O$	3.26	ord.	0.095	(Cleve, 1902.)
Methylamine Oxalate	20	"	5.24*	(Grant and James, 1917.)
Ethylamine Oxalate	20	"	5.86*	"
Triethylamine Oxalate	20	"	2.05*	"
Sulfuric Acid (1 *n*)	4.9	"	0.372	(Cleve, 1902.)

* The authors do not state whether their figures are for anhydrous or hydrated salt.

YTTERBIUM Dimethyl **PHOSPHATE** $Yb_2[(CH_3)_2PO_4]_6$.

100 gms. H_2O dissolve 1.2 gms. $Yb_2[(CH_3)_2PO_4]_6$ at 25° and 0.25 gm. at 95°. (Morgan and James, 1914.)

YTTERBIUM SULFATE $Yb_2(SO_4)_3.8H_2O$.

SOLUBILITY IN WATER.

(Cleve, 1902.)

t°.	Gms. $Yb_2(SO_4)_3$ per 100 gms. H_2O.	t°.	Gms. $Yb_2(SO_4)_3$ per 100 Gms. H_2O.	t°.	Gms. $Yb_2(SO_4)_3$ per 100 Gms. H_2O.
0	44.2	55	11.5	80	6.92
15.5	34.6	60	10.4	90	5.83
35	19.1	70	7.22	100	4.67

YTTERBIUM Bromonitrobenzene **SULFONATE** $Yb(C_6H_3Br.NO_2.SO_3, 1.4.3)_3.12H_2O$.

100 gms. sat. solution in water contain 7.294 gms. of the anhydrous salt at 25°. (Katz and James, 1913.)

YTTRIUM CHLORIDE YCl_3.

100 gms. alcohol dissolve 61.1 gms. YCl_3 at 15°. (Matignon, 1906.)
" " 60.5 gms. YCl_3 at 20°. (Matignon, 1909.)
" pyridine dissolve 6.5 gms. YCl_3 at 15°. (Matignon, 1906.)

YTTRIUM Cobalti**CYANIDE** $Y_2(CoC_6N_6)_2.9H_2O$.

1000 gms. aq. 10% HCl (d_{15} = 1.05) dissolve 2.78 gms. of the salt at 25°. (James and Willand, 1916.)

YTTRIUM GLYCOLATE $Y(C_2H_3O_3)_3.2H_2O$.

One liter of water dissolves 2.447 gms. of the salt at 20°. (Jantsch and Grünkraut, 1912–1913.)

YTTRIUM IODATE $Y(IO_3)_3.3H_2O$.

100 gms. H_2O dissolve 0.53 gm. yttrium iodate. (Berlin.)

YTTRIUM MALONATE $Y_2(C_3H_2O_4)_3.8H_2O$.

SOLUBILITY IN AQUEOUS MALONIC ACID AND AMMONIUM MALONATE SOLUTIONS.

(Holmberg, 1907.)

Solvent.	t°.	Gms. $Y_2(C_3H_2O_4)_3$ per 100 Gms. Solvent.
1 Gm. Am. Malonate per 10 cc. Solution	20	0.3
2 Gms. Malonic Acid per 10 cc. Solution	20	2.3

YTTRIUM Basic **NITRATE** $3Y_2O_3.4N_2O_5.2H_2O$.

EQUILIBRIUM IN THE SYSTEM YTTRIUM NITRATE, YTTRIUM HYDROXIDE AND WATER AT 25°. (James and Pratt, 1910)

The determinations were made with very great care. The mixtures were rotated 4½ months.

d_{25} of Sat. Sol.	Gms. per 100 Gms. H_2O. $Y(NO_3)_3$.	Y_2O_3 as $Y(OH)_3$.	Solid Phase.	d_{25} of Sat. Sol.	Gms. per 100 Gms. H_2O. $Y(NO_3)_3$.	Y_2O_3 as $Y(OH)_3$	Solid Phase.
1.0260	3.13	0.014	$Y(OH)_3$	1.4867	73.03	0 078	$3Y_2O_3.4N_2O_5.2H_2O$
1.1106	13 87	0.034	"	1.5587	89 06	0 074	"
1.1907	24.94	0.063	"	1 6259	103.80	0 075	"
1.2517	33 02	0.160	"$+3Y_2O_3$ $4N_2O_5.2H_2O$	1 6931	122 40	0 080	"
1.3268	44.35	0.114	$3Y_2O_3.4N_2O_5.2H_2O$	1.7440	137 10	0 083	" $+Y(NO_3)_3$
1.4104	58 61	0.095	"	1.7446	141 6	0	$Y(NO_3)_3$

YTTRIUM OXALATE $Y_2(C_2O_4)_3.9H_2O$.

One liter H_2O dissolves 0.001 gm. $Y_2(C_2O_4)_3$ at 25°, determined by the electrolytic method. (Rimbach and Schubert, 1909.)

100 gms. aqueous ammonium oxalate solution (3.26% $(NH_4)_2C_2O_4.H_2O$) dissolve 0.01714 gm. $Y_2(C_2O_4)_3.9H_2O$ at room temp. (Cleve, 1902)

100 gms. aq. 2.16 *n* H_2SO_4 dissolve 0.6884 gm. $Y_2(C_2O_4)_3$ at 25°. (Wirth, 1912.)

100 gms. aq. 4.32 *n* H_2SO_4 dissolve 1.4 gms. $Y_2(C_2O_4)_3$ at 25°. "

100 cc. aq. 20% methylamine oxalate dissolve 0.877 gm. yttrium oxalate at ord. temp.

100 cc. aq. 20% ethylamine oxalate dissolve 1.653 gms. yttrium oxalate at ord. temp.

100 cc. aq. 20% triethylamine oxalate dissolve 1.006 gms. yttrium oxalate at ord. temp. (Grant and James, 1917.)

YTTRIUM Potassium **OXALATE** $Y_2(C_2O_4)_3.4K_2C_2O_4.12H_2O$.

SOLUBILITY IN WATER AT 25°. (Pratt and James, 1911)

The determinations were made with great care. The mixtures were constantly rotated for 8 weeks.

d_{25} of Sat. Sol	Gms per 100 Gms. H_2O $Y_2(C_2O_4)_3$.	$K_2C_2O_4$.	Solid Phase.	d_{25} of Sat Sol	Gms. per 100 Gms. H_2O. $Y_2(C_2O_4)_3$.	$K_2C_2O_4$	Solid Phase.
1.008	Trace	1.31	Solid Solution	1 174	1.50	27 44	$Y_2(C_2O_4)_3.4K_2C_2O_4.12H_2O$
1.035	0.02	5.30	"	1.199	1.49	32.83	"
1.059	0.06	8.88	"	1.222	1.48	37.68	"
1.096	0.27	14.50	"	1.231	1.42	39.12	$K_2C_2O_4$
1.132	0.72	20.27	"	1.228	1.09	38 77	"
1.166	1.37	26 02	$Y_2(C_2O_4)_3$ $4K_2C_2O_4$ $12H_2O$	1.218	0	37.87	"

YTTRIUM Dimethyl**PHOSPHATE** $Y_2[(CH_3)_2PO_4]_6$.

100 gms. H_2O dissolve 2.8 gms. $Y_2[(CH_3)_2PO_4]_6$ at 25° and 0.55 gm. at 95°. (Morgan and James, 1914.)

YTTRIUM SULFATE $Y_2(SO_4)_3$.

SOLUBILITY OF YTTRIUM SULFATE IN AQUEOUS SOLUTIONS OF SODIUM SULFATE AT 25°. (James and Holden, 1913.)

Equilibrium was reached very slowly and it was necessary to rotate the mixtures for 14 months before final equilibrium was reached.

Gms. per 100 Gms. H_2O. $Y_2(SO_4)_3$.	Na_2SO_4.	Solid Phase.	Gms. per 100 Gms. H_2O. $Y_2(SO_4)_3$.	Na_2SO_4.	Solid Phase.
5.61	1.29	$Y_2(SO_4)_3$	1.90	14.89	$Y_2(SO_4)_3.Na_2SO_4.2H_2O$
6.38	3.85	"	1.79	16.51	"
7.40	6.21	"	1.86	18.44	"
8.43	8.53	" $+Y_2(SO_4)_3.Na_2SO_4.2H_2O$	2.99	19 96	"
5.86	7.57	$Y_2(SO_4)_3.Na_2SO_4.2H_2O$	3 04	21 05	"
4.75	7.72	"	2.27	27.14	"
3.42	10.14	"	1.52	28.22	"
2.36	11.36	"	1.61	28.13	"
2.02	13.42	"	5.38	0	$Na_2SO_4.10H_2O$

SOLUBILITY OF YTTRIUM SULFONATES IN WATER.

Sulfonate.	Formula.	t°.	Gms. Anhy. Sulfonate per 100 Gms. H_2O.	Authority.
Yttrium Benzene Sulfonate	$Y(C_6H_5SO_3)_3.9H_2O$	15	60.4	(Holmberg, 1907.)
" " *m* Nitro-benzene Sulfonate	$Y(C_6H_4.NO_2.SO_3)_3.7H_2O$	15	48.3	
Yttrium Bromonitrobenzene Sulfonate	$Y(C_6H_3Br.NO_2.SO_3.1.4.2)_3.10H_2O$	25	3.88	(Katz & James, '1[illegible]

YTTRIUM TARTRATE $Y_2(C_4H_4O_6)_3.5H_2O$.

SOLUBILITY IN AQUEOUS TARTARIC ACID AND AMMONIUM TARTRATE SOLUTIONS AT 20°. (Holmberg, 1907.)

Aq. Solvent.	Gms. $Y_2(C_4H_4O_6)_3$ per 100 Gms. Sat. Sol.	Aq. Solvent.	Gms. $Y_2(C_4H_4O_6)_3$ per 100 Gms. Sat. Sol.
1 gm. Am. Tartrate per 10 cc. solution	0.6	2 gms. Tartaric Acid per 10 cc. solution	0.02
2 gms. Am. Tartrate per 10 cc. solution.	1.1	4 gms. Tartaric Acid per 10 cc. solution	0.02

ZEIN (Protein from Corn).

SOLUBILITY IN AQUEOUS ALCOHOL SOLUTIONS AT 25°.
(Galeotti and Giampalmo, 1908.)

Dry powdered zein was added to the alcohol + water mixtures and the solutic kept at 25° and shaken frequently during 24 hrs. The removed undissolved re due was dried to constant weight and weighed.

Vol. % C_2H_5OH in Solvent.	Gms. Zein per 100 Gms. Sat. Sol.	Vol. % C_2H_5OH in Solvent.	Gms. Zein per 100 Gms Sat. Sol.
10	0.05	60	18.57
20	0.11	70	19.87
30	0.21	80	7.81
40	0.51	90	4.51
50	1.43	100	0.02

Similar results are given for the solubility of zein in mixtures of C_2H_5OH + H + $CHCl_3$ at 20° and $C_2H_5OH + H_2O$ + acetone at 25°.

ZINC ACETATE $Zn(C_2H_3O_2)_2.2H_2O$.

SOLUBILITY IN AQUEOUS ETHYL ALCOHOL AT 25°. (Seidell, 1910.)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $Zn(C_2H_3O_2)_2.2H_2O$ per 100 Gms. Sat. Sol.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $Zn(C_2H_3O_2)_2.2H_2O$ per 100 Gms. Sat. Sol.
0	1.168	30.80	60	0.920	10.60
10	1.127	27.20	70	0.880	7.80
20	1.090	23.70	80	0.850	5.50
30	1.055	20.40	90	0.830	4.20
40	1.015	17	95	0.825	4
50	0.970	13.80	100	0.796	1.18*

* = gms. anhydrous salt. The solid phase was $Zn(C_2H_3O_2)_2.2H_2O$ in all cases except this solution

100 gms. H_2O dissolve 41.6 gms. $Zn(C_2H_3O_2)_2.H_2O$ at 15°, *d* of sat. sol. = 1.1
(Greenish and Smith, 19

100 cc. anhydrous hydrazine dissolve 4 gms. zinc acetate with separation c white suspension at ordinary temperature. (Welsh and Broderson, 19

ZINC ARSENATE $Zn_3(AsO_4)_2.8H_2O$.

100 gms. 95% formic acid dissolve 0.26 gm. $Zn_3(AsO_4)_2$ at 21°. (Aschan, 19

ZINC ARSENITE $Zn_3(AsO_3)_2$.

100 gms. 95% formic acid dissolve 0.36 gm. $Zn_3(AsO_3)_2$ at 21°. (Aschan, 19

ZINC BENZOATE $Zn(C_7H_5O_2)_2$.

SOLUBILITY IN WATER.
(Pajetta, 1906.)

t°.	15.9°.	17°.	27.8°.	31.3°.	37.5°.	49.8°.	59.°
Gms. $Zn(C_7H_5O_2)_2$ per 100 gms. aq. solution	2.55	2.49	2.41	2.05	1.87	1.62	1.45

ZINC BROMIDE $ZnBr_2.2H_2O$.

SOLUBILITY IN WATER.
(Dietz, 1900; see also Etard, 1894.)

t°.	Gms. $ZnBr_2$ per 100 Gms. Solution.	Mols. $ZnBr_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $ZnBr_2$ per 100 Gms. Solution.	Mols. $ZnBr_2$ per 100 Mols H_2O.	Solid Phase.
−15	77.13	27.0	$ZnBr_2.3H_2O$	25	82.46	37.6	$ZnBr_2.2H_2O$
−10	78.45	29.1	"	30	84.08	42.3	"
− 5	80.64	33.3	"	37	86.20	50.0	"
− 8	79.06	30.2	$ZnBr_2.2H_2O$	35	85.45	46.9	$ZnBr_2$
0	79.55	31.1	"	40	85.53	47.4	"
+13	80.76	33.5	"	60	86.08	49.5	"
18	81.46	35.1	"	80	86.57	51.5	"
				100	87.05	53.8	"

ZINC BICARBONATE $Zn(HCO_3)_2$.

SOLUBILITY OF ZINC BICARBONATE IN WATER CONTAINING CARBON DIOXIDE.
(Smith, 1918.)

For description of the experimental method see iron bicarbonate, p. 336.

Atmospheres Pressure of CO_2, Calc by Henry's Law.	Results at 25°. Gm. Mols. Free H_2CO_3 per Liter.	Results at 25°. Gm. Mols. $Zn(HCO_3)_2$ per Liter	Results at 30°. Gm. Mols. Free H_2CO_3 per Liter.	Results at 30°. Gm. Mols. $Zn(HCO_3)_2$ per Liter.
4.12	0.1390	0.00194	0.1838	0.00215
5.33	0.1797	0.00211	0.3838	0.00277
7.64	0.2579	0.00242	0.4038	0.00286
10.61	0.3580	0.00270	0.4601	0.00308
12.16	0.4103	0.00278	0.6064	0.00324
13.29	0.4480	0.00291	0.6257	0.00337
19.73	0.6657	0.00317	0.7470	0.00352
20.65	0.6969	0.00319	0.8351	0.00376
22.56	0.7610	0.00343	1.0840	0.00339
40.61	1.3701	0.00445	1.1275	0.00429

The calculated pressures are lower than the actual pressures since Henry's Law does not hold at very high pressures.

"If zinc carbonate were not hydrolytically dissociated, its solubility in pure water at 25°, would be 4.58×10^{-6} gms. mols. per liter." (Smith, 1918.)

ZINC CARBONATE $ZnCO_3$.

Ageno and Valla (1911) report that the solubility of $ZnCO_3$ in water at 25° is $1.64.10^{-4}$ mols. = 0.206 gm. per liter.

One liter of aq. 5.85% NaCl solution dissolves 0.0586 gm. $ZnCO_3$ at 14°.
One liter of aq. 7.45% NaCl solution dissolves 0.0477 gm. $ZnCO_3$ at 14°.
(Cantoni and Passamanik, 1905.)

ZINC CHLORATE $ZnClO_3$.

SOLUBILITY IN WATER.

(Meusser, 1902; at 18°, Mylius and Funk, 1897.)

t°.	Gms. $Zn(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Zn(ClO_3)_2$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Zn(ClO_3)_2$ per 100 Gms. Solution.	Mols. $Zn(ClO_3)_2$ per 100 Mols. H_2O.	Sol'd Phase.
−18	55.62	9.70	$Zn(ClO_3)_2.6H_2O$	30	67.66	16.20	$Zn(ClO_3)_2.4H_2O$
0	59.19	11.08	"	40	69.06	17.29	"
8	60.20	11.72	"	55	75.44	24	"
15	67.32	15.96	"	Ice curve			
18	66.52	15.39	$Zn(ClO_3)_2.4H_2O$	−13	30.27	3.36	Ice
				− 9	26.54	2.80	"

Sp. Gr. of solution saturated at 18° = 1.916.

ZINC CHLORIDE $ZnCl_2$.

SOLUBILITY IN WATER.

(Mylius and Dietz, 1905; see also Dietz, 1900; Etard, 1894.)

t°.	Gms. $ZnCl_2$ per 100 Gms. Water.	Gms. $ZnCl_2$ per 100 Gms. Solution.	Solid Phase.	t°.	Gms. $ZnCl_2$ per 100 Gms. Water.	Gms. $ZnCl_2$ per 100 Gms. Solution.	Solid Phase.
− 5	14	12.3	Ice	9	360	78.3	$.2\frac{1}{2}H_2O + .H_2O$
−10	25	20.0	"	6	385	79.4	$ZnCl_2.2\frac{1}{2}H_2O$
−40	83	45.3	"	6	298	74.9	$ZnCl_2.1\frac{1}{2}H_2O$
−62	104	51.0	Ice + $ZnCl_2.4H_2O$	10	330	76.8	"
−50	113	53.0	$ZnCl_2.4H_2O$	20	368	78.6	"
−40	127	55.9	"	26	423	80.9	$.1\frac{1}{2}H_2O + ZnCl_2.H_2O$
−30	160	61.5	$.4H_2O + .3H_2O$	26.3	433	81.2	$.1\frac{1}{2}H_2O + ZnCl_2$
−10	189	65.4	$ZnCl_2.3H_2O$	0	342	77.4	$ZnCl_2.H_2O$
0	208	67.5	"	10	364	78.4	"
+ 5	230	69.7	"	20	396	79.8	"
6.5	252.4	71.6	"	28	436	81.3	$ZnCl_2.H_2O + ZnCl_2$
5	282	73.8	"	31	477	82.7	$ZnCl_2.H_2O$
0	309	75.5	$.3H_2O + .1\frac{1}{2}H_2O$	25	432	81.2	$ZnCl_2$
0	235	70.1	$ZnCl_2.2\frac{1}{2}H_2O$	40	452	81.9	"
6.5	252	71.6	$.2\frac{1}{2}H_2O + .3H_2O$	60	488	83.0	"
10	272	73.1	$ZnCl_2.2\frac{1}{2}H_2O$	80	543	84.4	"
12.5	303	75.2	"	100	615	86.0	"
11.5	335	77.0	$.2\frac{1}{2}H_2O + .1\frac{1}{2}H_2O$	262	∞	100.0	"

SOLUBILITY OF OXYCHLORIDES OF ZINC IN AQUEOUS SOLUTIONS OF ZINC CHLORIDE AT ROOM TEMPERATURE.

(Driot, 1910.)

Gms. per 100 Gms. H_2O. $ZnCl_2$.	Gms. per 100 Gms. H_2O. ZnO.	Solid Phase.	Gms. per 100 Gms. H_2O. $ZnCl_2$.	Gms. per 100 Gms. H_2O. ZnO.	Solid Phase.
8.22	0.0137	$ZnCl_2.4ZnO.6H_2O$	62.85	0.884	$ZnCl_2.4ZnO.6H_2O$
23.24	0.138	"	96	1.792	"
45.95	0.497	"	124.7	3.213	"
51.5	0.604	"	144.8	2.64	"
56.9	0.723	"	203	1.59	$ZnCl_2.ZnO.1\frac{1}{2}H_2O$

Results are also given for mixture of the oxychloride and oxide in aqueous zinc chloride solutions at various temperatures.

SOLUBILITY OF ZINC CHLORIDE-AMMONIUM CHLORIDE MIXTURES IN WATER.

(Meerburg, 1903.)

Isotherm for 0°.			Isotherm for 20°.			Isotherm for 30°.		
Gms. per 100 Gms. Solution.		Solid Phase.	Gms. per 100 Gms. Solution.		Solid Phase.	Gms. per 100 Gms. Solution.		Solid Phase.
$ZnCl_2$.	NH_4Cl.		$ZnCl_2$.	NH_4Cl.		$ZnCl_2$.	NH_4Cl.	
0	22.8	NH_4Cl	0.0	26.9	NH_4Cl	0.0	29.5	NH_4Cl
3.5	23.0	"	5.1	27.1	"	9.2	29.4	"
7.1	23.5	"	9.5	27.4	"	16.0	29.7	"
10.2	23.9	"	12.7	27.5	"	20.2	30.1	"
15.1	24.7	"	15.7	27.7	"	24.7	30.4	"
18.0	25.3	"	18.0	27.9	"	26.3	30.8	NH_4Cl+a
22.4	26.0	"	23.5	29.0	"	27.2	30.2	a
24.2	26.1	"	26.0	29.5	NH_4Cl+a	30.1	29.6	"
25.7	26.3	NH_4Cl+a	29.5	28.1	a	36.8	28.2	"
27.5	26.4	a	32.3	27.7	"	42.4	27.3	"
30.7	25.7	"	35.8	27.0	"	43.8	27.3	$a+b$
33.9	25.3	"	38.7	26.9	"	45.0	24.4	b
38.8	24.4	"	40.2	26.6	"	51.2	17.6	"
42.6	24.6	$a+b$	41.9	26.3	"	61.9	10.4	"
44.3	21.3	b	43.2	26.0	$a+b$	66.9	9.2	$ZnCl_2+b$
49.2	15.3	"	46.9	21.0	b	75.6	6.1	$ZnCl_2$
52.6	11.9	"	53.2	14.5	"	70.3	7.6	"
55.4	10.0	"	58.4	11.1	"	78.5	3.2	"
59.3	7.5	"	62.7	8.7	"	76.9	3.5	"
62.1	6.8	"	66.6	7.9	"	79.8	1.6	"
						81.6	0.0	"

$a = ZnCl_2.3NHCl_3$. $b = ZnCl_2.2NH_4Cl$.

100 gms. abs. acetone dissolve 43.5 gms. $ZnCl_2$ at 18°, d_{18} of sat. sol. = 1.14. (Naumann, 1904.)

100 gms. glycerol dissolve 50 gms. $ZnCl_2$ at 15.5°. (Ossendowski, 1907.)

100 cc. anhydrous hydrazine dissolve 8 gms. $ZnCl_2$ at room temp. (Welsh and Broderson, 1915.)

When 1 gm. of zinc as chloride is dissolved in 100 cc. of aq. 10% HCl and shaken with 100 cc. of ether, 0.03 per cent of the metal enters the ethereal layer. (Mylius, 1911.)

ZINC CHROMATES.

EQUILIBRIUM IN THE SYSTEM ZINC OXIDE, CHROMIUM TRIOXIDE AND WATER AT 25°.

(Gröger, 1911.)

An excess of ZnO was, in each case, shaken for 3 days at 25°, with gradually increasing concentrations of chromic acid.

Gms. per Liter Sat. Sol.		Solid Phase.	Gms. per Liter Sat. Sol.		Solid Phase.
ZnO.	CrO_3.		ZnO.	CrO_3.	
0.409	0.604	$4ZnO.CrO_3.3H_2O$	66.1	151	$4ZnO.CrO_3.3H_2O$
2.24	4.19	"	83.7	192	" $+3ZnO.2CrO_3.H_2O$
5.86	11.5	" $+3ZnO.CrO_3.2H_2O$	123	285	$3ZnO.2CrO_3.H_2O$
10.7	22.2	$3ZnO.CrO_3.2H_2O$	193	450	"
26.7	57.5	"	196	461	" $+ZnO.CrO_3.H_2O$
30.4	66.7	" $+4ZnO.CrO_3.3H_2O$	202	475	$ZnO.CrO_3.H_2O$
32.2	70.6	$4ZnO.CrO_3.3H_2O$	389	940	"

ZINC CINNAMATE $Zn(C_6H_5CH:CHCOO)_2$.

100 cc. sat. solution in water contain 0.144 gm. zinc cinnamate at 26.5°.
(De Jong, 1909.)

ZINC CYANIDE $Zn(CN)_2$.

100 cc. concentrated $Zn(C_2H_3O_2)_2$ + Aq. dissolve 0.4 gm. $Zn(CN)_2$.
100 cc. concentrated $ZnSO_4$ + Aq. dissolve 0.2 gm. (Joannis, 1882.)

100 gms. H_2O dissolve 0.24 gm. zinc mercuric thiocyanate, $ZnHg(CNS)_4$ at 15°.
(Robertson, P. W., 1907.)

ZINC FLUORIDE $ZnF_2.4H_2O$.

One liter of water dissolves 16 gms. at 18°. (Dietz, 1900.)

ZINC HYDROXIDE $Zn(OH)_2$.

One liter of water dissolves 0.0042 gm. ZnO at 18°, conductivity method.
(Dupre and Bialas, 1903.)
One liter of water dissolves 0.01 gm. at 25°. (Bodlander, 1898.)

SOLUBILITY OF ZINC HYDROXIDE IN AQUEOUS SOLUTIONS OF:

Ammonia and Ammonia Bases at 17°–19°. (Herz, 1902.)

Normality of the Base.	Normality of Dissolved Zn.	Gms. ZnO per 20 cc. Solution.
0.0942 NH_3	0.0011	0.00185
0.236 "	0.0110	0.0180
0.707 "	0.059	0.0958
0.0944 NH_2CH_3	0.0005	0.0008
0.472 "	0.0081	0.0132
0.944 "	0.03	0.0484
0.068 $NH_2C_2H_5$	0.0003	0.0005
0.51 "	0.0045	0.0074
0.68 "	0.0098	0.0161

Sodium Hydroxide at Ord. Temp. (Rubenbauer, 1902.)

Gms. per 20 cc. Solution: Na.	Zn.	Mol. Dilution of the NaOH.
0.1012	0.0040	4.50
0.1978	0.0150	2.33
0.4278	0.0442	1.06
0.6670	0.1771	0.70
0.9660	0.9630	0.48
1.4951	0.2481	0.31
2.9901	0.3700	0.16

Moist Zn $(OH)_2$ used. Solutions shaken 5 hours.

SOLUBILITY OF ZINC HYDROXIDE IN AQUEOUS SOLUTIONS OF AMMONIUM HYDROXIDE.

Results of Euler (1903).

t°.	Normality of Aq. Ammonia.	Mols. Zn per Liter.
15–17	0.485	0.013–0.010*
15–17	0.97	0.034
21	0.253	0.0029
21	0.259	0.0022*
21	0.500	0.0097
21	0.518	0.0070

Results of Bonsdorff (1904) at 25°.

Normality of Aq. Ammonia.	Gms. ZnO per Liter.	Normality of Aq. Ammonia.	Gms. ZnO per Liter.
0.311	0.85	0.321	0.34
0.825	3.84	0.643	0.845
1.287	7.28	1.215	2.70
		1.928	5.07
		2.570	7.01
		3.213	10.16

Euler states that the higher results of Herz are due to incompletely purified zinc hydroxide and uses material precipitated from the nitrate for his experiments. Different preparations of $Zn(OH)_2$ containing from 55 to 77 per cent H_2O were used and in the two cases marked * ZnO was used.

Bonsdorff used for his second series of determinations, $Zn(OH)_2$ precipitated from the nitrate and brought in moist condition into the ammonia solutions.

SOLUBILITY OF ZINC HYDROXIDE IN AQUEOUS POTASSIUM HYDROXIDE SOLUTIONS.

(Klein, 1912.)

The determinations were made by adding aq. $ZnSO_4$ solution (containing one gm. mol. per liter) to aq. KOH solutions until a permanent precipitate just appeared. The titrations are also recalculated to mols. per liter and correction made for the dilution of the KOH solution by the aq. $ZnSO_4$.

Normality of Aq. KOH.	cc. $ZnSO_4$ Sol. per 50 cc. Aq. KOH.	Calculated Mols. per Liter of Sat. Sol.		
		Oric Conc. KOH.	Corrected Conc. of KOH.	Conc. of Zn.
1	5.5	1	0.9	0.10
1.78	13.1	1.78	1.42	0.209
2	14.3	2	1.56	0.223
2.22	17.9	2.22	1.63	0.266
2.5	18.8	2.5	1.81	0.272
3	24.6	3	2.02	0.330
3.6	29.1	3.6	2.28	0.368
4	34	4	2.38	0.405
6	56 (?)	6	2.78	0.540

SOLUBILITY OF ZINC HYDROXIDE IN ONE PER CENT AQUEOUS SALT SOLUTIONS AT 16°–20°.

(Snyder, 1878)

The CO_2 free $Zn(OH)_2$ dissolved is calculated as milligrams Zn per liter of the given salt solution. Additional determinations are also given.

Aq. Salt Solution.	Mgs. Zn per Liter Solution.	Aq. Salt Solution.	Mgs Zn per Liter Solution.	Aq. Salt Solution.	Mgs. Zn per Liter Solution.
NaCl	51	K_2SO_4	37.5	K_2CO_3	0
KCl	43	$MgSO_4$	27	NH_4Cl	95
$CaCl_2$	57.5	KNO_3	17.5	NH_4NO_3	77
$MgCl_2$	65	$Ba(NO_3)_2$	25	$(NH_4)_2SO_4$	88
$BaCl_2$	38				

ZINC IODATE $Zn(IO_3)_2$.

100 gms. H_2O dissolve 0.87 gm. $Zn(IO_3)_2$ cold and 1.31 gms. hot.
(Rammelsberg, 1838.)

ZINC IODIDE ZnI_2.

SOLUBILITY IN WATER.

(Dietz, 1900; see also Etard, 1894.)

t°.	Gms. ZnI_2 per 100 Gms. Solution.	Mols. ZnI_2 per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. ZnI_2 per 100 Gms. Solution.	Mols. ZnI_2 per 100 Mols. H_2O.	Solid Phase.
−10	80.50	23.3	$ZnI_2.2H_2O$	0	81.11	24.2	ZnI_2
−5	80.77	23.7	"	18	81.20	24.4	"
0	81.16	24.3	"	40	81.66	25.1	"
+10	82.06	25.8	"	60	82.37	26.4	"
22	83.12	27.8	"	80	83.05	27.5	"
27	89.52	50.3	"	100	83.62	28.7	"

Sp. Gr. of sat. solution of the anhydrous salt at 18° = 2.725.

100 gms. glycerol dissolve 40 gms. ZnI_2 at 15.5°. (Ossendowski, 1907.)

ZINC NITRATE $Zn(NO_3)_2$.

SOLUBILITY IN WATER.
(Funk, 1900.)

t°.	Gms. $Zn(NO_3)_2$ per 100 Gms. Solution.	Mols. $ZnNO_3$ per 100 Mols. H_2O.	Solid Phase.	t°.	Gms. $Zn(NO_3)_2$ per 100 Gms. Solution.	Mols. $Zn(NO_3)_2$ per 100 Mols. H_2O.	Solid Phase.
−25	40.12	6.36	$Zn(NO_3)_2.9H_2O$	18	53.50	10.9	$Zn(NO_3)_2.6H_2O$
−22.5	40 75	6.54	"	25	55.90	12.0	"
−20	42.03	6.89	"	36.4	63.63	16.7	"
−18	43.59	7.34	"	36	64.63	17.4	"
−18	44.63	7.67	$Zn(NO_3)_2.6H_2O$	33.5	65.83	18.3	"
−15	45.26	7.86	"	37	66.38	18.8	$Zn(NO_3)_2.3H_2O$
−13	45.51	7.94	"	40	67.42	19.7	"
−12	45.75	8.01	"	41	68.21	20.4	"
0	48.66	9.01	"	43	69.26	21.4	"
+12.5	52.0	10 3	"	45.5	77.77	33.3	"

ZINC OXALATE $ZnC_2O_4.2H_2O$.

One liter H_2O dissolves 0.0057 gm. ZnC_2O_4 at 9.76°, 0.0064 gm. at 17.92° and 0.00715 gm. at 26.15°. (Kohlrausch, 1908.)

SOLUBILITY OF ZINC OXALATE IN AQUEOUS AMMONIUM OXALATE SOLUTIONS AT 25°.
(Kunschert, 1904.)

Mol. Normal $(NH_4)_2C_2O_4$	0.05	0.10	0.15	0.20	0.25
Mol. Zn per Liter	0.0022	0.0055	0 01055	0.0174	0.0257

Complex ammonia zinc oxalates are formed. When more than 0.15 free oxalate is present the complex has the formula, $(NH_4)_4Zn(C_2O_4)_3$. In the more dilute solutions it has the composition, $(NH_4)_2Zn(C_2O_4)_2$.

ZINC Ammonium PHOSPHATE $ZnNH_4PO_4$.

One liter sat. solution in water contains 0.0136 gm. $ZnNH_4PO_4$ at 10.5° and 0.0145 gm. at 17.5°. (Artmann, 1915.)

ZINC SULFATE $ZnSO_4$.

SOLUBILITY IN WATER.
(Cohen, 1900; at 50°; Callender and Barnes, 1897, Etard, 1894; Poggiale, 1843; Mulder.)

t°.	Gms. $ZnSO_4$ per 100 Gms. Solution.	Gms. $ZnSO_4$ per 100 Gms. Water.	Solid Phase.	t°.	Gms. $ZnSO_4$ per 100 Gms. Solution.	Gms. $ZnSO_4$ per 100 Gms. Water.	Solid Phase.
−5	28.21	39.30	$ZnSO_4.7H_2O$	25	38.94	63 74	$ZnSO_4.6H_2O$
0.1	29.54	41.93	"	39	41.22	70.06	$.6H_2O + 7H_2O$
9.1	32.01	47.09	"	50	43.45	76.84	$ZnSO_4.6H_2O$
15	33.81	50 88	"	70	47.5	88.7	$.6H_2O + .H_2O$
25	36.67	57.90	"	80	46.4	86.6	$ZnSO_4.H_2O$
35	39.98	66.61	"	90	45.5	83.7	"
39	41.21	70.05	"	100	44.7	80.8	"
−5	32.00	47.08	$ZnSO_4.6H_2O$	120	41.7	71.5	"
01	33.09	49.48	"	140	38.0	61.3	"
				160	33.0	49.3	"

The Sp. Gr. of a sat. sol. of $ZnSO_4$ in water at 15° is 1.452. (Greenish and Smith, 1902.)
Data for the solubility of $ZnSO_4$ in water at high pressures are given by Cohen and Sinnige (1909, 1910.)

SOLUBILITY OF ZINC SULFATE — SODIUM SULFATE MIXTURES IN WATER.
(Koppel, Gumpery, 1905.)

t°.	Gms. per 100 Gms. Solution.		Gms. per 100 Gms H_2O.		Mols. per 100 Mols. H_2O.		Solid Phase.
	$ZnSO_4$.	Na_2SO_4.	$ZnSO_4$.	Na_2SO_4.	$ZnSO_4$.	Na_2SO_4.	
0	27.19	5.33	40.30	7.90	4.50	1.01	$ZnSO_4.7H_2O + Na_2SO_4.10H_2O$
5	27.85	6.27	42.28	9.52	4.71	1.21	
25	17.58	15.63	26.32	23.40	2.94	2.96	$ZnNa_2(SO_4)_2.4H_2O$
30	17.66	15.58	26.47	23.44	2.95	2.97	"
35	17.59	15.70	26.36	23.52	2.94	2.98	"
40	17.75	15.72	26.68	23.63	2.98	2.99	"
10	29.16	7.16	45.79	11.24	5.11	1.42	$ZnNa_2(SO_4)_2.4H_2O + ZnSO_4.7H_2O$
15	30.70	6.40	48.81	10.17	5.45	1.29	
20	32.51	5.36	52.34	8.62	5.84	1.09	
25	34.36	4.41	56.15	7.22	6.27	0.91	
30	36.28	3.80	60.55	6.34	6.76	0.81	
35	38.18	3.30	65.25	5.64	7.28	0.71	
38	38.83	2.90	66.64	4.98	7.44	0.63	$ZnNa_2(SO_4)_2.4H_2O + ZnSO_4.6H_2O$
40	38.26	2.78	64.89	4.71	7.24	0.60	
10	27.91	7.92	43.50	12.34	4.85	1.565	$ZnNa_2(SO_4)_2.4H_2O + Na_2SO_4.10H_2O$
15	24.28	10.90	36.92	16.71	4.12	2.12	
20	19.14	14.58	28.77	21.95	3.21	2.79	
25	13.31	19.94	19.93	29.87	2.22	3.785	
30	6.96	27.75	10.67	42.51	1.19	5.39	
35	5.61	30.03	8.72	46.61	0.971	5.91	$ZnNa_2(SO_4)_2.4H_2O + Na_2SO_4$
40	5.96	28.65	9.16	43.83	1.02	5.555	

SOLUBILITY OF ZINC SULFATE IN AQUEOUS ETHYL ALCOHOL.
(Schiff, 1861.)

Concentration of Alcohol	10 per cent	20 per cent	40 per cent
Gms. $ZnSO_4.7H_2O$ per 100 Gms. Solution	51.1	39	3.45

100 gms. abs. methyl alcohol dissolve 0.65 gm. $ZnSO_4$ at 18°, 5.90 gms. $ZnSO_4.7H_2O$ at 18°.

100 gms. 50 per cent methyl alcohol dissolve 15.7 gms. $ZnSO.7H_2O$ at 18°. (de Bruyn, 1892.)

100 gms. glycerol dissolve 35 gms. zinc sulfate at 15.5°. (Ossendowski, 1907.)

ZINC SULFIDE ZnS.

One liter H_2O dissolves $70.6.10^{-6}$ mols. ZnS = 0.0069 gm. at 18°, determined by the conductivity method, assuming complete dissociation and hydrolysis. (Weigel, 1906, 1907.)

ZINC SULFITE $ZnSO_3.2H_2O$.

100 gms. H_2O dissolve 0.16 gm. $ZnSO_3.2H_2O$. (Houston and Trichborne, 1890.)

ZINC SULFONATES

SOLUBILITY IN WATER.

Name.	Formula.	t°.	Gms. Anhy. Salt per 100 Gms. H_2O.	Authority.
Zinc β Naphthalene Sulfonate	$(C_{10}H_7.SO_3)_2Zn.6H_2O$	25	0.45	(Witt, 1915.)
Zinc 2-Phenanthrene "	$(C_{14}H_9.SO_3)_2Zn.6H_2O$	20	0.083	(Sandquist, '12.)
" 3- " "	$(C_{14}H_9.SO_3)_2Zn.4H_2O$	20	0.19	"
" 10- " "	$(C_{14}H_9.SO_3)_2Zn.6H_2O$	20	0.15	"

SOLUBILITY OF ZINC PHENOLSULFONATE, *p* $(C_6H_4.OH.SO_3)_2Zn.8H_2O$, IN AQUEOUS ALCOHOL SOLUTIONS AT 25°.

(Seidell, 1910.)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $(C_6H_4.OH.SO_3)_2Zn.8H_2O$ per 100 Gms. Sat. Sol.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $(C_6H_4.OH.SO_3)_2Zn.8H_2O$ per 100 Gms. Sat. Sol.
0	1.185	39.8	80	1.057	40.7
20	1.161	40.7	90	1.047	41.4
40	1.139	42.1	92.3	1.048	41.9
47	...	42.2	95	1.052	42.9
60	1.106	41.6	100	1.075	48.8

100 gms. H_2O dissolve 37 gms. $(C_6H_4.OH.SO_3)_2Zn.8H_2O$ at 15° and d_{15} of sat. sol. = 1.162. (Greenish and Smith, 1902.)

ZINC TARTRATE $C_4H_4O_6.Zn.2H_2O$.

SOLUBILITY IN WATER.

(Cantoni and Zachoder, 1905.)

t°.	Gms. $C_4H_4O_6.Zn\ 2H_2O$ per 100 cc. Solution.	t°.	Gms. $C_4H_4O_6.Zn\ 2H_2O$ per 100 cc. Solution.	t°.	Gms. $C_4H_4O_6.Zn\ 2H_2O$ per 100 cc. Solution.
15	0.019	40	0.060	65	0.100
20	0.022	45	0.073	70	0.088
25	0.036	50	0.087	75	0.078
30	0.041	55	0 116	80	0.059
35	0.055	60	0.104	85	0.041

ZINC VALERATE $Zn(C_4H_9COO)_2.2H_2O$.

SOLUBILITY OF ZINC VALERATE IN AQUEOUS ALCOHOL SOLUTIONS AT 25°.

(Seidell, 1910.)

Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $Zn(C_4H_9COO)_2.2H_2O$ per 100 Gms. Sat. Sol.	Wt. % C_2H_5OH in Solvent.	d_{25} of Sat. Sol.	Gms. $Zn(C_4H_9COO)_2.2H_2O$ per 100 Gms. Sat. Sol.
0	1.004	1.41	85	0 836	2.15
20	0.972	0.75	90	0.827	3.20
40	0.936	0.76	92.3	0.828	5.50
60	0 894	1.15	95	0.832	8.80
80	0.848	1.70	100	0.844	15.60

ZIRCONIUM SULFATE $Zr(SO_4)_2$.

SOLUBILITY OF ZIRCONIUM SULFATE IN AQUEOUS SULFURIC ACID AT 37.5°.

(Hauser, 1907)

Gms. per 100 Gms. Sat. Sol. ZrO_2.	Gms. per 100 Gms. Sat. Sol. SO_3.	Solid Phase.	Gms. per 100 Gms. Sat. Sol. ZrO_2.	Gms. per 100 Gms. Sat. Sol. SO_3.	Solid Phase.
19.5	25.46	$Zr(SO_4)_2.4H_2O$	0.15	56.7	$Zr(SO_4)_2\ 4H_2O$
18.8	27	"	0.50	57.5	"
16.2	29.1	"	2	59.5	"
9.6	32.3	"	4.4	61.4	" $+Zr(SO_4)_2.H_2SO_4.3H_2O$
5.3	34.7	"	4.55	61.5	$Zr(SO_4)_2.H_2SO_4.3H_2O$
3.51	36.01	"	3.33	63.8	"
1.03	38.2	"	1.80	64.2	"
0.46	39.8	"	1.12	66.8	"
0.33	42.1	"	0.96	68.4	"
0.14	46.8	"	0.10	81.5	$Zr(SO_4)_2.H_2SO_4.H_2O$

Results at 22° show only slight differences from the above figures, hence, the temperature coefficient for this salt is quite small. In an earlier paper Hauser (1905) gives data for the basic sulfate $4ZrO_2.3SO_3.14H_2O$.

METHODS FOR THE DETERMINATION OF SOLUBILITY

A quantitative determination of a solubility consists essentially of two operations; the preparation of the saturated solution and its subsequent analysis. In those cases where these steps are performed separately the method may, in general, be designated as the analytical and in those where they are combined, as the synthetic. In both cases, however, the consideration of first importance is the assurance that final equilibrium between solvent and solute has been reached. Since this point is that at which no further change occurs in the relation between the amount of the compound in solution and that remaining undissolved, the only criterion of saturation is the evidence that the concentration of the solution has not changed during a longer or shorter interval of time, during which those conditions which would tend to promote such a change have been allowed to operate.

Of the conditions which promote most effectively the attainment of equilibrium between a solute and a solvent, the provision for the intimate contact of the two is most important. In other words, only by the thorough mixing which agitation or effective stirring provides can the point of saturation be reached with certainty. In the case of the reciprocal solubility of liquids, the point of equilibrium is usually attained within a much shorter period than in the case of solids dissolved in liquids. In the latter case, the necessary disintegration of the solid, incident to its solution in the liquid, is a process which is restricted to the surface layers of the solid, and, therefore, unless a large area, such as a finely divided state provides, is available, and unless that portion of the solvent which has acted upon a given surface area is repeatedly replaced by fresh solvent, the process of solution will be greatly retarded. It is quite evident that, although a solution in contact with even very finely divided solid may promptly become saturated in the immediate vicinity of the solid without stirring, the distribution of the dissolved material to the remainder of the solvent would depend upon diffusion, and since the rate at which this proceeds would diminish as the concentration differences became equalized, the process would take place

at a gradually diminishing rate. If the point of equilibrium is approached from supersaturation, the above remarks apply with equal effect, since only at the surface of the solid can the excess of salt leave the solution and, without other provision than diffusion for successively bringing the entire amount of the solution in contact with the solid, the deposition of the excess of dissolved material can occur only at a very slow rate. The importance of active and continuous agitation of the solid and solution, in effecting saturation, cannot, therefore, be too strongly emphasized. It may in fact be assumed that determinations of the solubility of solids, made without continuous agitation, are always open to the suspicion that the results do not represent the final equilibrium which such data are required to show.

Since solubility is a function of temperature, the accurate control of the temperature in making a solubility determination is another one of the indispensible requisites of accuracy. In general, it may be stated therefore, that every procedure designed for preparing a saturated solution must include provision for the accurate control of the temperature and for active and continuous agitation or stirring of the solution. In the case of the solubility of gases, which will be considered in a separate section, provision for the control of the pressure must also be made.

It is obvious that since the solubilities of various compounds differ, and that of one compound is affected by the presence of another, the accurate determination of this constant for a particular molecular species presupposes that only this one substance is present in the pure solvent. That is, accuracy of results demand that only pure compounds be involved in a given determination, consequently, no effort should be spared to make it certain that the highest possible purity of both solute and solvent has been attained.

Apparatus for the Determination of the Solubility of Solids by the Analytical Method. — The types of apparatus which have been developed for the preparation of saturated solutions of solids in liquids differ principally in respect to whether designed for multiple or single determinations at a given temperature. Examples of the first type are illustrated by Figs. 1 and 2.

It will be noted that in the one case (Fig. 1) the bottles containing the solutions are stationary and the liquid in each and in the constant temperature bath is kept in motion by means of revolving stirrers. This form of apparatus was used by Moody and Leyson (1908) for the determination of the solubility of lime in water and is particularly adapted for relatively slightly soluble compounds for

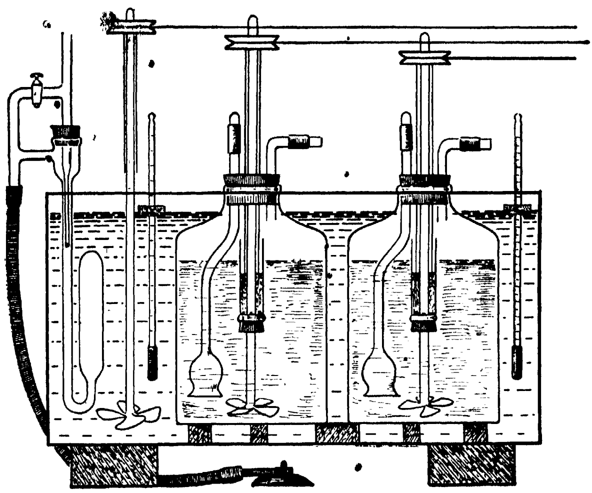

FIG. 1.

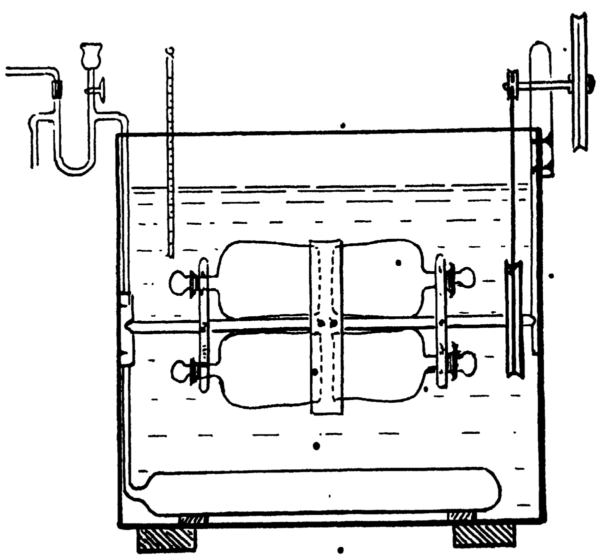

FIG. 2.

which rather large quantities of the saturated solution are needed for accurate analysis. There is also shown in the figure the provision for withdrawing the saturated solution through a filter within the inverted thistle tube. The stirrers in the bottles are fitted with mercury seals to prevent access of air containing carbon dioxide. Other features of the apparatus will be readily understood from the drawing.

A more common type of apparatus, designed for the simultaneous saturation of several solutions at the same temperature, is that illustrated by Fig. 2, in which the bottles containing the solutions are slowly rotated in the constant temperature bath. The form shown is that described by Noyes (1892). This type of apparatus has the advantage that the solid is, to a large extent, kept in suspension in the liquid and, therefore, offers the most favorable opportunity for continuous and uniform contact with the solution. Many examples of this form of apparatus, differing principally in size and in the direction of movement of the containers, are described in the literature.

Of the second type of apparatus, designed for a single determination at a given temperature, many varieties have been developed for particular conditions. Of these, the following examples have been selected as typical of this class and, it is hoped, will illustrate most of their desirable features. They are, in general, adaptations of earlier designs and it is not intended that the name given in connection with each is that of the investigator who deserves the credit for originating the type. The drawings will, for the most part, be readily understood without detailed explanations. The dimensions are not stated, since they can usually be varied to suit the needs of almost any problem.

In Fig. 3 is shown the apparatus used by the Earl of Berkeley (1904) for the very careful determinations of the solubility of inorganic salts in water. The features of particular interest in connection with it are, that the water bath itself is made to serve as the temperature regulating device, and the apparatus for withdrawing and simultaneously filtering the saturated solution is a combination of pipet and pycnometer. This was provided with ground glass caps for each end and the stem was accurately graduated. It was, of course, carefully standardized before use. The flexible iron plate shown was made of a disc from the receiver of a telephone. The apparatus was used for determinations at temperatures between 30° and 90° and the range of variations from the set temperature of the bath was, for 2–3 hour periods, within

about 0.2°. For the inner vessel containing the salt, the range was about 0.05°. At each temperature two determinations of density and solubility were mad ; one on the solution obtained by stirring a supersaturated solution in contact with solid salt, and the other on the solution obtained by stirring an unsaturated solution in contact with an excess of salt.

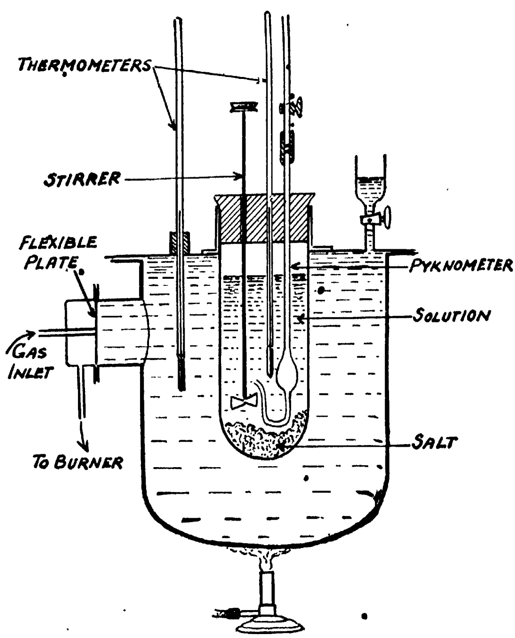

FIG. 3.

In the case of determinations at the boiling point a special apparatus was required. Two forms, described by the Earl of Berkeley (1904), are shown in Figs. 4 and 5. The first was used for the less soluble salts and consisted of an outer tube *A* containing water and an inner tube *B* containing salt and solution. By boiling the water vigorously and closing the side tube *C*, steam passing through the tube *D* stirred the solution thoroughly and the temperature rose to the boiling point of the saturated solution and remained constant when saturation was attained. The second form of apparatus (Fig. 5) was devised for use with extremely

soluble salts. In these cases it was found that the larger quantity of steam required for thorough stirring dissolved so much salt that it was necessary to have a very large excess present. In this apparatus the steam was generated in a boiler *A* and conducted through the tube *B* to the bottom of the large test tube *C* containing the excess of salt and solution. The test tube was immersed in the oil

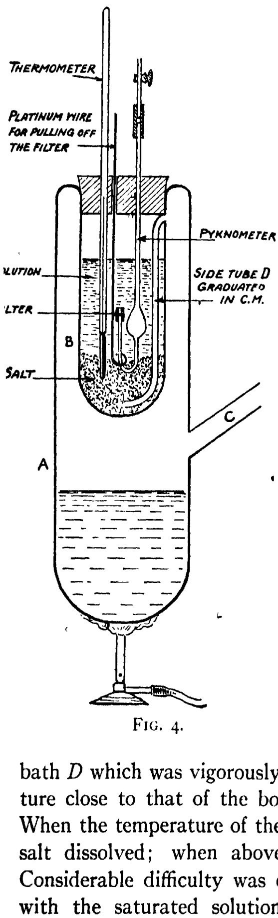

FIG. 4.

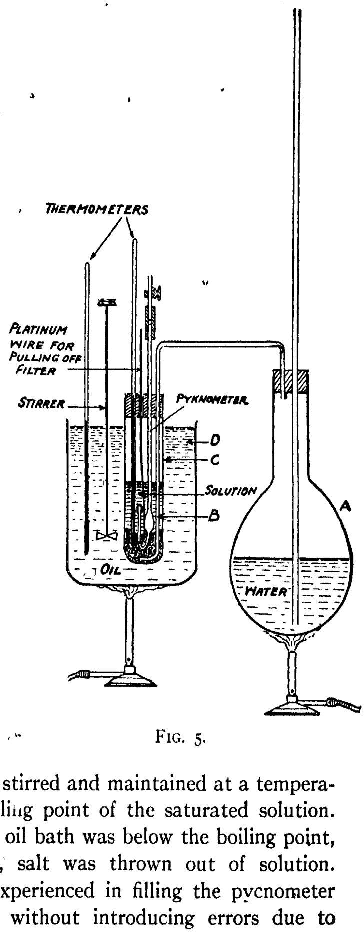

FIG. 5.

bath *D* which was vigorously stirred and maintained at a temperature close to that of the boiling point of the saturated solution. When the temperature of the oil bath was below the boiling point, salt dissolved; when above, salt was thrown out of solution. Considerable difficulty was experienced in filling the pycnometer with the saturated solution without introducing errors due to steam bubbles caused by the suction which was applied.

A comparatively simple form of the type of apparatus used by Victor Meyer in 1875 and modified by Reicher and van Deventer (1890) and by Goldschmidt (1895), is described by Hicks (1915) and shown in the accompanying Fig. 6. A glass cylinder *A* is closed at

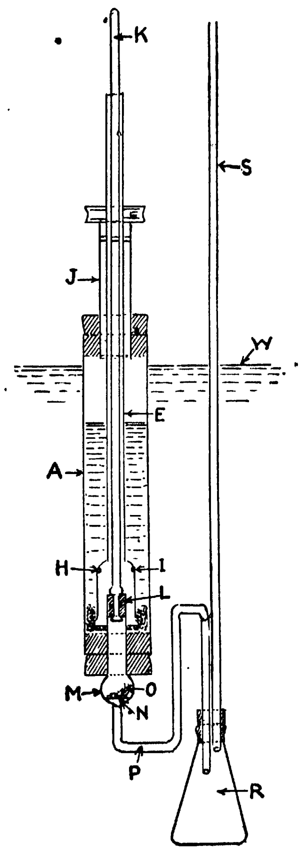

FIG. 6.

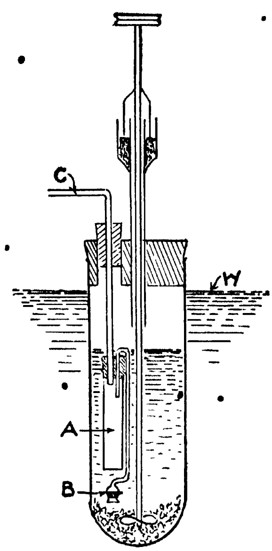

FIG. 7.

each end with large one-hole rubber stoppers. The mixture of salt and solution is contained in this cylinder and is stirred by the rotation of the tube *E* which is provided with an enlargement at its lower end in which there are two small holes at *H* and *I*. The

stirrer rotates in the bearing formed by the hollow wooden cylinder J. The glass rod K carries a rubber stopper L which closes the filtering tube M, in which a platinum cone N supports an asbestos filter O. The siphon P connects the filtering tube with the flask R which is provided with an outlet through the small tube S. The apparatus is immersed in a constant temperature water bath W, to about the level shown After stirring the mixture of salt and solution a sufficient length of time for attainment of saturation, the undissolved salt is allowed to settle and the rubber stopper is withdrawn from the filter tube by means of the glass rod K. Suction is applied through the tube S to hasten the filtering and the clear solution collected, at the temperature of the bath, in the previously weighed flask R.

A similar apparatus was used by Walton and Judd (1911), for determination of the solubility of lead nitrate in pyridine. This is shown in Fig. 7 and consists of a glass test tube fitted with a stirrer which turns in a mercury seal, thus preventing loss of solvent by evaporation or the admission of moisture from the air. To take a sample of the saturated solution, the weighing tube A was introduced into the larger tube through a hole in the stopper. After reaching the temperature of the bath the stirrer was stopped, the end of the small tube B, which was covered with a piece of closely-woven muslin, was dipped below the surface of the solution and the liquid drawn into A by applying suction at C. The tube A was then removed, weighed and the contents analyzed.

An apparatus which was used by Donnan and White (1911), for the determination of equilibrium in the system palmitic acid and sodium palmitate is shown in Fig. 8. The stirring in this case was accomplished by means of a current of dry air, free of carbon dioxide. The apparatus consists of two parts, namely, an inner chamber E, where equilibrium was attained, and an outer case A, designed for isothermal filtration. The whole was immersed in a thermostat to the level W. A side tube B permitted connection with a filter pump. C is a weighing bottle to receive the filtered saturated solution and D a Gooch crucible provided with a paper filter. The cork, closing A, was covered with a plastic layer to render it air-tight. The tube at the lower end of E was closed with a ground glass plug F, the stem of which was enlarged to a small bulb at G and then drawn out to pass easily through H, leaving an air free outlet around it. The small cork I was used to support the stopper when lifted to allow the contents of E to flow down for filtration. The dry air by which the mixture was

stirred was drawn through K by applying suction at H. The preheating of this air was accomplished by drawing it through a thin spiral immersed in the thermostat. The connection between the equilibrium apparatus and preheater was made through a mercury seal, which permitted lifting the apparatus easily without damage to the fragile preheater permanently mounted in the bath. This apparatus provided for the recovery, separately, of

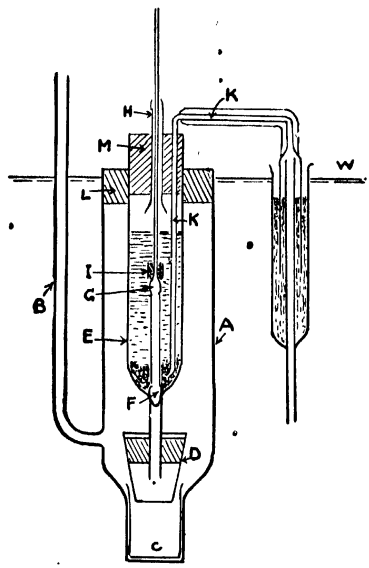

FIG. 8.

the saturated solution and undissolved solid. These authors also describe an improved electrically heated and controlled constant temperature bath.

Determinations at lower temperatures than can be constantly maintained with the aid of a water bath require special forms of apparatus which permit of temperature control under more or less restricted conditions. An apparatus of this type, which was used by Cohen and Inouye (1910), for determination of the solubility of phosphorus in carbon disulfide, is shown in Fig. 9, and is intended for the range of temperature between $-10°$ and $+10°$. The saturating vessel D consists of a glass cylinder to the upper

end of which is cemented a steel collar E, containing a deep channel. A mixture of litharge and glycerol was used as the cementing material for this purpose. The inverted steel cover F fits into the channel of this collar and the seal of the joint is effected, in the usual way, by means of a layer of mercury. The cover F is provided with a brass tube K, to which the pulley M is attached, and

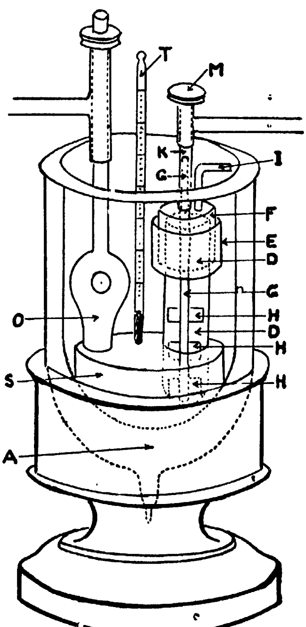

FIG. 9.

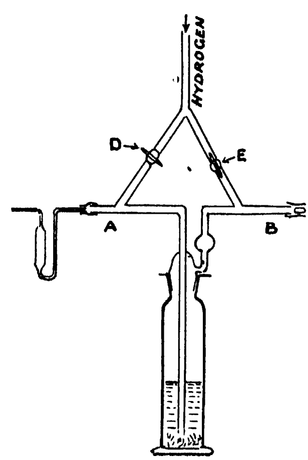

FIG. 10.

is also pierced by the tightly cemented-in glass tube I. The glass rod G, containing on its lower end the three stirring wings $H\ H\ H$, is cemented into the brass tube K. The saturating vessel is, for stability, tightly fastened in a hole in a block of lead, S, contained in the Dewar cylinder A. An atmosphere of CO_2 in the saturating vessel is provided by introducing CO_2 under pressure through I and allowing the excess to escape through the mercury seal in E. After charging the apparatus, I is closed with a rubber tube and plug and the stirrers $H\ H\ H$ set in motion. A Witt stirrer, O, keeps the contents of the bath in rapid circulation. Water is

used in the bath for temperatures above 0°, and alcohol for those below 0°. The regulation of the temperature is accomplished by addition of ice or solid CO_2 as found necessary and, therefore, requires very close attention on the part of the experimenter.

A novel and simple form of apparatus, which was used by Bahr (1911), for the determination of the solubility of thallium hydroxide at temperatures up to 40° is shown in Fig. 10. As will be seen, this

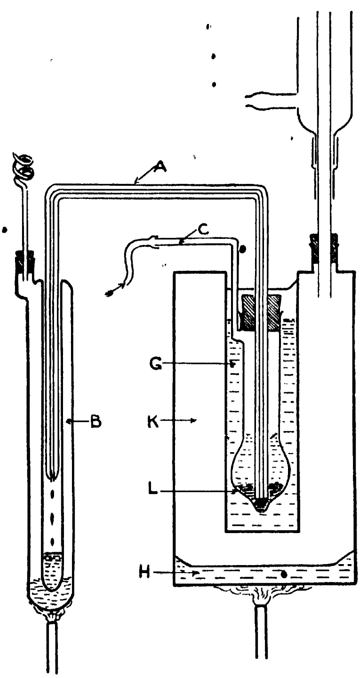

FIG. 11.

consists of a gas washing flask to the arms of which a Y tube provided with two stop-cocks is sealed. The inside walls of the apparatus were coated with hard paraffin and the required amounts of thallium hydroxide and water introduced. It was then immersed in a water bath and the contents stirred by means of a current of hydrogen, which entered as shown and with A and E closed, passed through D and out at B. When it was desired to

remove a sample of the solution for analysis, B and D were closed and the liquid forced through A into the pycnometer by means of gas pressure entering through E. For temperatures above 40°, the form of apparatus shown in Fig. 11 was used. In this case K represents a copper cylinder with double walls, of which the inner compartment G, contains concentrated salt solution which is stirred by a stream of air (not shown), and the outer compartment contains a layer of heating liquid H. The glass tube L contains the mixture of thallium hydroxide and water which is stirred by means of a current of hydrogen (not shown). When saturation is attained the tube A, of small bore and thick walls and provided with a small asbestos filter, is introduced and the saturated solution forced over into the receptacle B by pressure of hydrogen which enters at C. The heating liquid in B is the same as used in H. The following heating liquids with the boiling points shown were used: Allyl chloride, 46°; Ethylene chloride, 55°; Chloroform, 61°; Methyl alcohol, 66°; Benzene, 80°; Benzene-Toluene mixture, 91°; Water, 100°.

A somewhat more elaborate apparatus, in which the constant temperature is maintained by means of the vapor of a boiling liquid, is shown in Fig. 12. This apparatus was developed by Tyrer (1910) for the very accurate determination of the solubilities of anthraquinone, anthracene and phenanthraquinone in single and mixed organic solvents. The solvent with excess of the solute was placed in A and kept in constant agitation by means of the vertically acting stirrer shown. The tube A is surrounded by a bath of vapor which circulates through the cylinder B, condenses in C, and returns to the boiling flask M. When the solution is saturated it is allowed to settle, and the clear solution run out (by raising the tube D) into a small graduated flask E, which is maintained at the same temperature as the solution A. The temperature of the vapor bath is varied by changing the pressure under which the liquid in the flask M is boiling. For this purpose, the manostat P is provided. The temperature can, with care, be maintained constant to 0.01°. For this purpose the apparatus must be air-tight, the liquid in the boiling flask must not bump (which is entirely prevented by placing a layer of mercury in the flask) and a pure boiling liquid must be used.

Although illustrations of special forms of apparatus designed for securing equilibrium in solubility determinations could be extended far beyond the number given, it is believed that the principal features have been made clear and it will no doubt be possible to

adapt the devices here shown to many other cases for which accurate determinations of solubility may be desired.

Separation of Saturated Solution from Undissolved Solid. — The next point, after the establishment of equilibrium between the

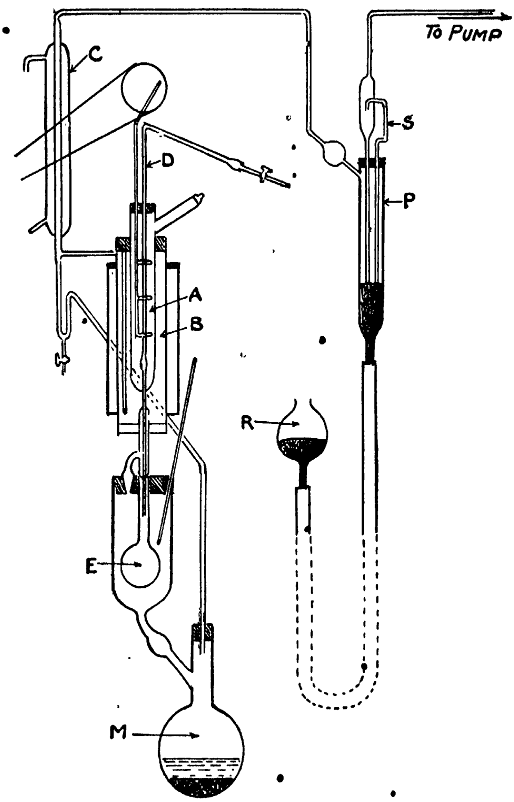

Fig. 12.

solvent and solution, is the matter of successfully separating the saturated solution from the undissolved solid, preparatory to its analysis. There are, undoubtedly, many cases where this is a very serious problem. This is especially so for extremely soluble compounds, which yield viscous solutions as well as for those which do not readily settle out of the solution or cannot be removed by

ordinary filtration. It is, of course, necessary to maintain the mixture at the temperature at which saturation was obtained until the complete separation of the solution and solid has been effected. The operation should, therefore, as a general thing, be conducted in the same bath used for preparing the saturated solution. Several forms of apparatus designed for this purpose are shown in the diagrams given in the preceding pages. For solutions which can be readily separated from the undissolved solid, a graduated pipet to which a stem with a plug of filtering material can be attached and which is adapted to being easily weighed, is the most convenient.

Analysis of the Saturated Solution. — The weight of a known volume of the perfectly clear solution, that is, its specific gravity, should always be determined. This weighed quantity of solution, or a known dilution of it, furnishes a very convenient sample for the determination of the amount of dissolved compound.

In regard to the analysis, the procedure must be selected entirely on the basis of the number and character of the constituents present. In cases of the solubility of single non-volatile compounds, in solvents which can be more or less easily removed by volatilization, the plan in most general use is the evaporation of a known amount of the solution to dryness and weighing the residue. Special forms of apparatus to be used for this purpose have been proposed from time to time. These are, usually, vessels with tubular openings, arranged so that a current of dry air can be drawn over the surface of the heated sample.

In the case of solubility determinations in which the saturated solution contains more than one dissolved compound, the application of the usual gravimetric or volumetric procedures will, of course, be necessary. Where unique methods have been developed, a brief reference to them will usually be found in the body of the book, in connection with the results for the compound in question.

In certain cases, where the direct determination of the amount of the dissolved compound present in the solution would be very difficult or impossible, an indirect method can sometimes be used. For this purpose, a carefully weighed amount of the compound must be used, and, after the period of saturation, the undissolved residue is filtered off under conditions which reduce losses to a minimum and, after drying to its original condition, it is weighed, and the amount which has been dissolved found by subtracting the weight of the undissolved residue from the quantity originally present.

Identification of the Solid Phase. — As already mentioned in the chapter on General Information, the solubility of a compound, which is capable of existing in several forms, depends upon the particular form in which it is present in contact with the saturated solution. The question of the composition of the solid phase is, therefore, of considerable importance for the accurate determination of solubility. Although the identification of the solid phase presents little difficulty in the majority of cases, it sometimes happens that it can be made only by a more or less indirect method. The principal reason for this is that adhering solution can usually not be completely removed from the solid phase and the analysis, consequently, does not give direct information of the required accuracy.

A method which has been used considerably for identifying the solid phase is that known as the *residue method* of Schreinemakers (1893). It is based on the principal that if an analysis is made of both the saturated solution and of a mixture of the saturated solution and the solid phase of unknown composition, the two points so obtained, when plotted on a coördinate system, lie on a line connecting the point representing the composition of the solid phase and the solubility curve of the system. Similar analyses of another saturated solution of the system and of its mixture with the solid phase, locate another such line. Since all lines so determined when extended, pass through the point representing the composition of the solid phase, their intersection locates this point definitely.

Although the original description of this method by Schreinemakers was illustrated by an example drawn on the rectangular system of coördinates, it has been used much more extensively, in a practical way, in connection with the later developed equilateral triangular diagram. In this case, each apex of the triangle represents one of the three components of the system, each point on a leg, a mixture of two, and each point within the triangle a mixture of all three components. When a number of saturated solutions are analyzed, the results correspond to points on the solubility curve of the system. If now some of the solid phase with adhering solution is removed from each mixture and analyzed, it is evident that the results thus obtained, being for samples made up of both the saturated solution and the solid phase, give points which lie on lines connecting the two. The points on the curve for the pure saturated solutions being known, it is necessary only to connect them with the points for the corresponding mixtures of solid phase and saturated

solution, and to prolong the lines to their common intersection. This will necessarily be at the point representing the composition of the pure solid phase.

In applying the residue method of Schreinemakers, if the intersecting lines which fix the point corresponding to the solid phase meet at a very narrow angle, definite information as to its composition may not be secured. For cases such as these, a procedure to which the name "*tell-tale*" method was given by Kenrick (1908) and which is described in detail by Cameron and Bell (1910), has been developed. This method consists in adding to the mixture a small amount of an entirely different compound which remains wholly in the solution. After equilibrium has been reached, a portion of the saturated solution and of the solid phase with adhering solution are analyzed, and the quantity of the added "tell-tale" compound in each determined. From the result, showing the concentration of the added compound in the saturated solution, and the amount of it found in the mixture of solid and solution, the quantity of solution in contact with the solid can be calculated. Since the composition of the solution is also known, the difference between the composition of the solid plus solution and of the amount of solution known to be present, is the composition of the pure solid.

Transition Temperatures can frequently be accurately determined by relatively simple means, and since such data are useful in establishing fixed points on solubility curves they are valuable adjuncts to directly determined solubility data.

Synthetic Method. — The procedures which have, so far, been mentioned are all classed as analytical methods of solubility determination. In contradistinction to these is the equally useful reverse process, by which the solvent and solute are brought together in previously measured quantities and the temperature ascertained at which the solution is saturated. To this procedure the designation synthetic method of solubility determination has been applied. One of the earliest investigators to use this method extensively was Alexejeff (1886) and it is, therefore, frequently referred to as the Alexejeff synthetic method of solubility determination.

The synthetic method can, of course, be used both for the solubility of solids in liquids and for liquids in liquids, but it is in the latter case that it is of greatest service. Its points of superiority, particularly in the case of the reciprocal solubility of liquids, are that the upper limits of the determinations can be extended far beyond the boiling point temperature and are, in fact, limited only by the resistance of the glass to pressure or to the action of the

liquid. Only small quantities of the solute and solvent are required for a determination. It is applicable to compounds for which quantitative methods of analysis are not available or are of a tedious character. The mixtures, being contained in sealed tubes, are not subject to the action of constituents of the air, nor are losses, due to volatilization, to be feared. Although, in the case of solids, difficulties incident to the supersaturation, resulting from failure of the crystals to separate on cooling, are encountered, with liquids the point of saturation is made instantly and strikingly evident by the beginning of opalescence or clouding which occurs, and errors due to supersaturation are rarely encountered. A sure criterion that supersaturation does not occur rests on the observation of the temperature at which the cloudy solution again clears. If this temperature coincides with the temperature of the beginning of opalescence, it is certain that supersaturation has not occurred. The observation of the temperature of saturation can be repeated as often as desired, and the accuracy of the determination is ordinarily limited only by the care taken in making it.

The limitations of the method, aside from the supersaturation which may occur in the case of solids, are principally those resulting from the low temperature coefficients of solubility possessed by certain compounds, and which usually occur in the vicinity of maxima or minima of solubility curves. Although a "critical clouding" occurs in the vicinity of the so-called critical solution point, this possesses a characteristic appearance which is easily distinguishable from the clouding observed at the saturation point, and errors of observation due to it are not to be apprehended. In fact, it has been pointed out that supersaturation disappears at the critical point, and the synthetic method is ordinarily very accurate in the vicinity of the critical solution temperature.

Since, by the synthetic method the results are necessarily obtained under different pressures, this question has been given consideration from the theoretical and the practical side. Although it is possible that extremely high pressures would exert an influence, the conclusion appears justified that under ordinary conditions, in which pressures of 10 atmospheres are not exceeded, no notable effect would be produced. The solubility curves obtained by this method do not show any abnormalities due to this cause.

In the case of the determination of the solubility of solids by the synthetic method, the operation consists in preparing a mixture of a carefully determined amount of the solvent and of the solid, and subjecting it to gradually increasing temperature and to constant

agitation, while a continual observation of the changes taking place in the solid is made. When all but a few small crystals have dissolved, the change in temperature is regulated much more carefully and note is taken of the point at which the edges of these final crystals begin to change from sharp to rounded, or vice versa, or where the sizes of the particles visibly increase or diminish. Care must, of course, be taken not to allow the last portions of the solid to dissolve; otherwise, on cooling, considerable supersaturation may occur before the solid begins to separate from solution. The method is, naturally, most serviceable where the change in solubility with temperature is considerable, and where convenient methods for the direct analysis of the solution are not available.

The procedure of a determination in the case of the reciprocal solubility of liquids consists in introducing by means of capillary funnels weighed amounts of the two liquids into small glass tubes and sealing the ends. The amount of air space in the tubes should be kept low. Many convenient devices for weighing and introducing the liquids have been described. In the case of very volatile liquids it may be necessary to introduce them in thin walled bulbs, which can be broken after the tube containing the mixture has been sealed. The tube is then placed in a large beaker of water, or higher boiling liquid if necessary, and heat applied until the contents of the tube, on being shaken, become homogeneous. The temperature is then allowed to fall very slowly and an observation made, while the tube is constantly agitated, of the temperature of first appearance of opalescence. This observation can be repeated as many times as desired and the temperatures of appearance and disappearance of the clouding, which usually differ by only a few tenths of a degree, can be ascertained with certainty.

Since, by the synthetic method the data are for irregular intervals of temperature, in order to obtain results for a particular temperature it is necessary to plot the several determinations on coördinate paper and from the solubility curve so obtained, read the value for the temperature in question.

Freezing-point Method. — A modification of the synthetic method, which is applicable particularly to solutions which contain relatively large amounts of the dissolved compound, is that which consists in a determination of the freezing-point of the mixture. This point is, in fact, the temperature at which the separating solid compound is in equilibrium with the solution.

The difference between the freezing-point determination and the observation of the point of growth or diminution of a crystal in a

liquid is that, in the former, the establishment of equilibrium is recognized exclusively by the change of the thermometer. The solution is cooled gradually, during which the thermometer sinks slowly to a point below the freezing temperature. As soon as the first crystal appears, either spontaneously or by intentional introduction (seeding), the thermometer rises suddenly to the freezing-point and remains stationary for some time.

This method can, of course, be used in a large number of cases for the determination of solubility. Those portions of the solubility curves of salts in water for which ice is the solid phase, are practically always determined in this way and it may be said, in general, that for determinations made at low temperatures, the freezing-point method is to be selected whenever possible.

For the practical execution of the method the very well known apparatus of Beckmann is most convenient and satisfactory. The determinations must, of course, be made with all the refinements which have been developed for accurate freezing-point measurements.

The method has been used extensively for the discovery of addition compounds. Its use for this purpose is based upon the principle that if to a pure compound, A, a second, B, is added, the freezing-point of A is lowered; similarly the freezing-point of B is lowered by A, and the two descending curves thus obtained intersect at the eutectic. If, however, a compound, $A_x B_y$ is formed, this also acts as a pure substance and its freezing-point is lowered by either A or B. Hence the freezing-point lines do not meet at a single eutectic but exhibit in this case a maximum, the position of which indicates the composition of the compound.

Volume Change Method. — Still another method, which is a modification of the synthetic, is that designed to indicate the reciprocal solubility of liquids by a determination of the volume changes which occur when two relatively sparingly miscible liquids are shaken together in a closed vessel. The apparatus consists usually of a cylindrical receptacle which is provided with a constricted graduated section either at one end or near the middle. Such volumes of liquids are chosen that the meniscus separating them lies in the constricted graduated tube. The determination consists in superimposing measured volumes of each liquid and noting the position of the meniscus before and after a period of shaking at constant temperature. From the increase or decrease of volume of the two layers, as estimated from the change in position of the meniscus, the reciprocal solubility of the two liquids is calculated. It is to be

noted, however, that the solubility of liquids is in practically all cases reciprocal, and without an analysis of the two layers the true solubility can not usually be deduced.

Titration Method. — A special case of the reciprocal solubility of liquids is that representing equilibrium in ternary systems yielding two liquid layers. Such equilibria are usually determined by relatively simple titration procedures, but for the interpretation and description of the results, special terms have been developed and these require more or less detailed explanation.

When a third liquid is added to a mixture of two others which are miscible to only a slight extent, the added liquid, if soluble in each of the others, will distribute itself between the two and an equilibrium will be reached. If the two layers are then analyzed and the results plotted on coördinate paper, two points, corresponding to the two layers, will be obtained. If more of the third liquid is added, equilibrium will again be established after a short period of shaking and the analysis of the two layers, to which the designation *conjugate* layers has been given, will fix two more points when plotted on the coördinate paper. The process may be repeated until a considerable number of points have been obtained. When this has been done, it will always be found that these points are the locus of a smooth curve, to which the designation *binodal* curve has been given. If the pairs of points corresponding to the conjugate layers are connected, the lines so obtained are defined as *tie lines.* Since it is evident that with the continued addition of the third or *consolute* liquid, a point must finally be reached at which the resulting mixture will no longer separate into two conjugate layers, the tie lines successively determined as above described, will become shorter and shorter until finally the last one is reduced to the point corresponding to the homogeneous mixture of the three components. To this is given the name *plait point.*

Although for the above example a ternary system made up of three liquids has been taken, there are a large number of salts and other solid compounds which, when dissolved in mixtures of liquids of certain concentrations, cause the latter to separate into conjugate liquid layers. These systems have aroused much interest from time to time and considerable data for them are given in the literature.

Since it is usually difficult and frequently impossible to analyze directly a homogeneous mixture of liquids, and thus determine the points on a binodal curve, a simple titration method for this purpose has come into general use. By means of this a homogeneous mixture of known amounts of two of the components is titrated with

the third just to the point of initial separation of the second layer, which is usually very sharply indicated by the appearance of clouding or opalescence. The procedure may also be reversed and the consolute liquid added just to the point of clearing of the cloudy mixture of the other two. By this plan the synthetically derived composition of one of the two conjugate layers and thus of one point on the binodal curve is known. The determination of the tie line and therefore, the identification of the corresponding point on the curve for the conjugate liquid, requires an additional experiment for its location. Several procedures for this purpose have been developed. They usually depend upon the determination of one or more constants of specially prepared pairs of conjugated liquids, such as their specific gravities or refractive indices. In the case of mixtures of which one member can be easily determined analytically, tie lines can be located by the quantitative determination of this member in pairs of conjugated liquids.

In general, the titration method for the determination of the solubility of liquids is applicable to many cases. The facts, that equilibrium is attained so promptly in liquids and that the evidence of the appearance of a second insoluble layer is usually so striking, make it of great value. Refinements have been introduced such as the addition of liquid or solid dyes to the mixture in order to facilitate the detection of the end point, and the development of particular forms of apparatus for measuring and weighing the liquids. The constituents of the mixtures are usually weighed but the volume relations and, therefore, the specific gravities can also be approximately estimated, by using graduated vessels for making the titrations, and measuring in them the volumes of the final mixtures. A very ingenious method for ascertaining indirectly the composition of the liquid mixtures in the case of the system naphthalene, acetone and water, is described on p. 444.

As a usual thing the temperature coefficients are not very great in the case of liquid mixtures and the very accurate control of the temperature is not imperative. When such control is necessary, however, the use of a thermostat does not seriously complicate the determination.

Distribution Coefficients. — As mentioned above, when a third compound is added to a mixture of two liquids which are relatively immiscible, it will dissolve to a certain extent in each and the composition of the two layers represent conjugate points on the binodal curve for the system. The results are, however, of interest from another point of view, namely that of the distribution of the com-

pound between the two solvents. This distribution coefficient is, in many cases, of considerable interest in connection with analytical methods based on shaking out procedures and also in connection with such problems as the molecular state of compounds in solution, their dissociation and other points of theoretical interest. Distribution coefficients have, therefore, been studied to a large extent and much data for them are available. In general, the determinations are made by relatively simple methods. The amount of the compound present in a definite amount of each layer, after equilibrium has been established by adequate agitation, is determined in any manner most convenient. If the total amount of solute is known, and that found in one layer, the amount in the other can, of course, be calculated by difference. The results are usually expressed on the volume basis, since it is the ratio of the amounts present in the same molecular state in equal volumes of the two layers which is a constant, independent of temperature and concentration.

It is evident that when the concentration at the saturation point is considered, the amount of the compound which enters each layer depends upon its solubility in the liquid, consequently the distribution coefficient is the relation of the solubilities of the dissolved substance in the two solvents. Variations from this, aside from changes in molecular state, etc., in one or the other solvent are due to such causes as the reciprocal solubility of the so-called immiscible solvents, which will, of course, be influenced by the presence of the dissolved compound, especially at the higher concentrations. Variations of the coefficient with temperature would result in cases where the solubilities of the compound in the two solvents do not change at the same rate with temperature.

Electrolytic Conductivity Method. — Of the physical properties which can be used for the determination of the concentration of a solution, such as specific gravity, refractive index, etc., the electrolytic conductivity is of particular value in the case of those very sparingly soluble compounds which yield solutions too dilute to be analyzed by gravimetric or volumetric methods. By its use the progress of the saturation can be followed without separating the undissolved solid from the solution, or even removing the portion used for the determination. The special electrical equipment which is required, however, and the need for water of exceptional purity and of vessels of particular qualities, restrict its general use.

The method of calculating the concentration from the conductivity is based on the assumption that at the very great dilutions

involved, complete dissociation occurs. Therefore, the limiting value to which the equivalent conductivity approaches at infinite dilution is, for practical purposes, attained, and $\Lambda = \Lambda_\infty = l_a + l_k$, where l_a and l_k are the ionic conductivities of the anions and kations. These values are known for all the principally occurring ions. The observed specific conductivity κ is, however, connected with the equivalent conductivity and the concentration η by the equation $\Lambda = \frac{\kappa}{\eta}$, in which η represents the concentration in gram-equivalents per cubic centimeter. Rearrangement and substitution give $\eta = \frac{\kappa}{l_a + l_k}$. From this equation the solubility of the substance under investigation is calculated by substituting the measured specific conductivity of the solution and the known values of the ionic conductivities.

The Solubility of Gases in Liquids. — When a gas and a liquid are intimately mixed by shaking, a definite amount of the gas will be dissolved by the liquid and, simultaneously, the vapor of the liquid will mix with the gas in the space above the liquid. The partial pressure of the liquid in the gas space is almost exactly the same as that of the pure liquid at the solution temperature, since the influence of the relatively slight amount of dissolved gas is insignificant in by far the most cases. The amount of gas which is dissolved depends both on the nature of the gas and of the liquid and is, furthermore, a function of the temperature, and pressure.

In regard to the influence of pressure, the absorption law of Henry holds for the most part, when the gas solubility is not too great. According to it, the amount of pure gas, which is taken up at constant temperature by a given amount of liquid is proportional to the pressure of the gas.

The temperature acts almost always in the sense that the solubility decreases as the temperature rises.

The solubilities of gases are usually expressed either in terms of the Bunsen "Absorption Coefficient" β, or the Ostwald "Solubility Expression" l. Definitions of these are given on p. 227.

The experimental methods for the determination of the solubility of gases vary according to the nature of the gas. For those which dissolve in relatively large amounts and can be analytically determined with accuracy, the saturated solution may be analyzed by ordinary quantitative methods. Thus, in the case of the solubility of sulfur dioxide in aqueous solutions of salts (see p. 706, results by Fox, 1902), the solutions were saturated by passing a stream of the

gas through them at atmospheric pressure and, when equilibrium was attained, a measured portion of the solution was withdrawn, transferred to an excess of standardized iodine solution and the excess of the latter titrated with thiosulfate. A gravimetric procedure was used by Christoff (1905) for the determination of the solubility of carbon dioxide in aqueous salt solutions. In this case the solutions were weighed before and after the passage of the gas through them and the increase in weight, after applying necessary corrections, taken to represent the solubility at the temperature of the experiment and at atmospheric pressure. The absorption flasks were of special shape and the gas was previously passed through a series of U tubes, containing the same aqueous solution, in order to prevent loss of water from the experimental solution which, otherwise, would have occurred.

In the great majority of cases, however, gas solubility is determined by a method based upon the measurement of the volume of the gas absorbed. The apparatus consists essentially of an absorption flask for the liquid, connected by means of a tube of small bore to a graduated buret in which the gas is measured above mercury, the level of which can be altered by raising or lowering a container connected with the buret by means of a rubber tube. Many forms of this apparatus have been described and the disadvantages of the earlier forms have gradually been remedied. A relatively simple form of this apparatus, but one which embodies the essential features required for accuracy, is that described by McDaniel (1911) for the determination of the solubility of methane, ethane and ethylene in a large number of organic solvents at various temperatures.

This apparatus is shown in Fig. 13. *A* is an ordinary gas buret and *B* an absorption pipet of the form first used by Ostwald. "The buret and pipet are connected by means of the glass capillary *M* sealed directly onto each, so that the whole forms one solid piece of glass apparatus *without rubber or cement connections of any kind;* thus any possibility of leaks from these extremely troublesome sources is entirely avoided. The whole apparatus is clamped solidly to a rigid support so that it can be taken up in the hands and shaken for the purpose of bringing the gas into intimate contact with the liquid. The pipet and buret are each provided with a three-way stopcock, *C* and *D*. These can be turned in such a way as to allow the gas to sweep out the air from the connecting capillary. By the same means the two vessels may also be connected directly with each other as well as separately with the outside air or source

of gas supply. The pipet and buret are each provided with a water jacket, P and Q. The temperature of each is regulated by means of the electrically heated coils K and L." These coils are of manganin wire and are connected in series. The rate of evolution of heat in the jackets was adjusted in the first place by varying the length of the manganin wire, until the temperature was the same in each jacket. Stirring was accomplished by blowing air through the tubes I and J. The differences in temperature between the pipet and buret were never greater than 0.1°.

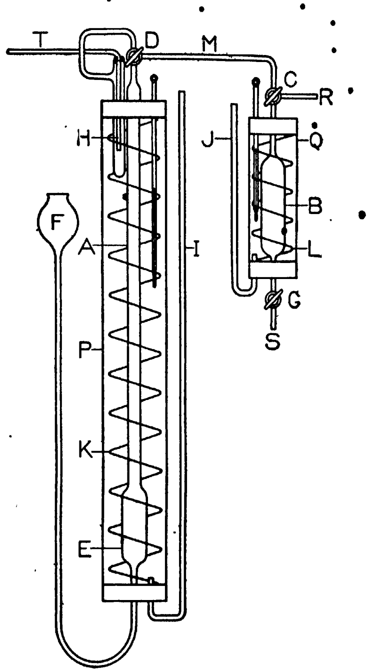

FIG. 13.

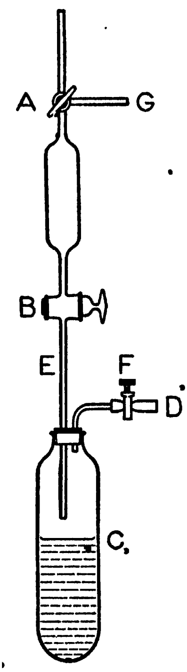

FIG. 14.

In carrying out a determination by this method it is, of course, necessary that the solvent be completely free of dissolved air or other gas. This is perhaps the most important part of the determination and a special form of apparatus for the purpose is described by McDaniel (1911) and is shown in Fig. 14. "The liquid was boiled under diminished pressure in the flask C attached directly

to the lower opening of the pipet by means of the rubber stopper as shown in the figure. Connection with the air pump is made at D. During the boiling the lower opening of the inlet tube E is above the surface of the liquid in C, the stopcock B being closed. When the air has been completely expelled, the screw pinchcock F is closed while the air pump is still in operation. The flask C is now raised until the lower end of E reaches nearly to the bottom of the flask. The air pump is now connected at G and the cock H opened so as to make connection with the pipet. B is now opened and the inflow of air through D regulated by gradually opening F in such a manner that the liquid is very slowly forced up into the pipet. In this manner the liquid never comes into contact with the air under full atmospheric pressure but only under greatly diminished pressure. The absorption of air under these conditions can only be inappreciable, especially since the liquid in the flask remains perfectly quiet, and only the lower portion is used."

Having filled the pipet B, Fig. 13, with the air-free solvent as just described, "T is connected with the source of gas supply and the cocks C and D are turned in such a way as to allow the gas to sweep out the air from the capillary, M. The buret is then filled in the usual manner by lowering the leveling tube F, the cock D having been turned so as to connect T with E. Care is taken to keep the entering gas under a slight pressure by keeping the mercury level in F slightly above that in A. This prevents air from entering through any leaks in the train connecting the gas generator with the buret." The gas must be completely saturated with the vapor of the solvent and this, with other than aqueous solvents, may require, in addition to drawing it through some of the solvent in H, that a thin layer be placed in the buret and time allowed for it to saturate the gas sample.

"After again allowing the current of gas to flow through the capillary M for a short time the buret and pipet are connected with each other by turning the three-way cocks D and C in the proper direction. The determination of the amount of absorption is then made as follows: A portion of the gas is passed into the pipet by raising F and opening G, the displaced liquid being caught in a graduated cylinder. The cock C is closed and the gas and liquid in the pipet brought into intimate contact with each other by shaking the whole apparatus. C is now opened to allow gas to enter from the buret to replace that absorbed. This process is repeated until, on opening C, there is no further decrease in the volume of gas in A. The volume absorbed is found by subtracting from the original

volume of gas, the volume remaining in the buret plus the volume in the pipet. The volume of gas in the pipet is equal to the volume of liquid drawn off. The volume of liquid remaining is easily calculated from the known volume of the pipet. The absorption coefficient or 'solubility' is the ratio of the volume of gas absorbed, measured at the temperature of the experiment, to the volume of the saturated liquid. It may be reduced to the coefficient used by Bunsen by dividing by $(1 + \alpha t)$."

In the case of the majority of investigators who have used this method, particularly for determinations at high or low temperatures, the absorption pipet has been kept at the temperature of the experiment and the gas measuring buret at room temperature, the two being connected by means of a flexible capillary which permits the absorption pipet to be independently shaken. This arrangement makes it necessary, in calculating the absorption coefficients, to apply the usual corrections for temperature and vapor pressure to the volume of gas in the buret. This is a complication which in some cases causes uncertainties in regard to the accuracy of the results as finally calculated.

A somewhat more elaborate form of apparatus than that just described was developed by Drucker and Moles (1910) for determinations in cases where the solubility is very small. These authors give results for hydrogen and nitrogen in aqueous solutions of glycerol. The particular feature of the apparatus is that only about one-tenth the usual amount of solvent is employed and solubilities as low as only one-tenth that of nitrogen in water at 25° can be measured.

An apparatus designed for determinations at very high pressures, using a Caillet compression tube, is described by Sander (1911–12). It was used for determination of the solubility of carbon dioxide in water, alcohols, and other organic solvents. The principle involved is that the pure gas is first compressed above mercury in a graduated tube and the volumes corresponding to given pressures noted. Similar readings are then taken for the same gas after a small accurately measured amount of solvent has been introduced into the graduated tube. The difference between the two volumes at the same temperature and pressure, reduced to 1 kg. per sq. cm. and 1 cc. of liquid, represents the solubility of the gas in the given solvent.

Finally, attention should be called to the method of determination of gas solubility based on the principle that, for volatile solutes which obey the laws of Dalton and Henry, the amount which is carried away by an inert gas when known volumes are bubbled

through solutions of known strength of volatile solute, can be used to measure the comparative solubilities in solvents of different concentrations. An example of this method is the determination of the solubility of ammonia in aqueous salt solutions by Abegg and Riesenfeld (1902). The very ingenious apparatus consists of a generator for developing a stream of $H_2 + O_2$ from aqueous NaOH, by means of an electric current measured with the aid of a copper voltmeter, and the volume of gas thus determined. This was passed through a spiral in the vessel containing the ammonia solution of known concentration. The mixed gases passing out of this were received in a third vessel containing 5 cc. of 0.01 *n* HCl. Electrodes were provided in this vessel and, by means of conductivity measurements, the point determined at which all of the HCl became saturated with NH_3. Since the volume of the $H_2 + O_2$ required for this purpose was known, the partial pressure of the NH_3 in the mixture could be directly ascertained. Comparative determinations of the vapor pressure of the ammonia in water and a series of salt solutions made in this way were calculated to ammonia solubilities on the basis of the relation that, for two solutions of equal ammonia content, the ammonia pressure is reciprocally proportional to the solubility of the ammonia in them.

AUTHOR INDEX[1]

[1] The abbreviations of the names of the journals referred to in this index agree, for the most part, with those adopted for Chemical Abstracts. They will, therefore, be readily understood in all but a few cases. One abbreviation which differs from that used in Chemical Abstracts is Proc. k. Akad. Wet. (Amst.) instead of Proc. Acad. Sci. Amsterdam. It refers to the English edition of Verslag koninkl ke Akademie van Wetenschappen te Amsterdam.

Another abbreviation which has been adopted for the present index is the use of "Tables annuelles" for the French title, Tables annuelles de Constantes et Données Numerique de Chemie, de Physique et de Technologie, of the International Tables of Constants and Numerical Data published in Paris under the direction of the general secretary, Professor Marie. Of the three volumes which have been published, Vol. 1 contains data for the year 1910 and was issued in 1912; Vol. 2 is for the year 1911 and appeared in 1913; and Vol. 3 contains data for 1912 and was issued in 1914.

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[1] Changed to Ann. chim. in 1914. [2] Changed to [illegible] Coll. Sci. (Kyoto) in 1914.